Weltdatenbank Abfluß
Bundesanstalt für Gewässerkunde
Koblenz, Deutschland

Global Runoff Data Centre
Federal Institute of Hydrology
Koblenz, Germany

Report No. 18

GRDC Status Report 1997

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Annexes to the Report

Database development

In 1997, data were received for 237 stations. 85 stations were added as new stations in the database, while 151 of the already existing stations were updated. 17 countries have contributed data to the GRDC (see table 1 and annex 1 to this report).

Country	New	Updated	Total
Uruguay	6	2	8
United Kingdom	0	9	9
Russian Federation	1	24	25
Nepal	20	3	23
Greece	7	3	10
Israel	2	4	6
Hungary	0	17	17
Germany	1	10	11
Netherlands	0	1	1
USA	0	7	7
Italy	1	1	2
Ecuador	8	23	31
Guyana	0	6	6
Mekong Basin	0	32	32
Trinidad & Tobago	5	0	5
Australia	27	9	36
Slovenia	8	0	8
Σ	86	151	237

Table 1: Number of Stations, Update 1997

Over 50% of the newly included stations came from Australia and Nepal (a country mission to Nepal was performed in 1997). For the greatest part of the stations, time series could be obtained which reach into the early or mid 90's, so that the peak of the data shifted into more recent years. Annex 2, which displays the number of stations for every year, shows that the shift of data towards more recent years continued, but data providers must be requested to provide data in a more timely manner where this is possible in order to keep the database up to date. The peak of the time series lies around 1980, which is not so bad for historical time series - however, for many hydrological or climatological research purposes it would be useful to have more recent data, because of the overlapping with other datasets (e.g. remote sensing data), which are often only available for the last recent years. An institutionalized transfer of data from the providing countries to the GRDC is followed by a relatively small number of countries up to now.

The database now consists of 3658 stations, from which 2184 stations provide mean daily discharge data and 3232 stations provide mean monthly discharge data. An impression of the station locations worldwide and their spatial distribution gives annex 3 (world map). A complete station catalogue is available at the GRDC on request or can be downloaded directly from the Internet home page of the GRDC under the URL of http://www.bafg.de/grdc.htm. As an alternative download the ftp-server of the Federal Institute of Hydrology may be used: ftp://anonymous@www.bafg.de/pub/grdc/cat, where a zip-file with the 32-bit version of the database catalogue tool is ready to be downloaded.

Data acquisition activities

On various occasions, GRDC reiterated its request for data provisions for the Centre. Country missions to Nepal and India as well as to Slovenia, the Mekong Secretariat, Russia and the Ukraine and other good contacts established in 1996 with countries of Latin America and the Carribean resulted in a very satisfactory data acquisition in general, however, data deliveries from most African countries remain very low.

In general, one of the most important tasks for the near future will be to collect data for the major rivers of the world with a maximum of overlapping time series. Major difficulties in the collection of hydrological data are political constraints of many countries and the institutional capacity of the data-keeping organisations to provide data. In many cases, even the data of one country are often distributed over different institutions, depending on the administrational structure of the hydrological service of the country. In this respect, there is a growing importance of regional, multinational projects as FRIEND, WHYCOS or others for the global exchange of hydrological data and related information. Likewise, as the example of the Mekong Secretariat shows, close contacts to such basin- and regional institutions are gaining in importance.

Quality control

As stated in the GRDC Policy Guidelines for the Dissemination of Data (annex 4), the providing agencies are responsible for the quality of the data. The import of raw data from the data providing agencies into the GRDC database includes an obligatory screening procedure of the data for obvious errors. Due to the time- and personnel-intensive testing procedures for in-depth quality control, the use of the GRDC Plausibility Software and other statistics-based software is applied only for specified projects and data sets within the GRDC.

In 1997, there were two datasets which were examined by a more detailed plausibility control. The first one was the dataset of 35 stations compiled for the Second Interim Report (Report No. 12) for the Arctic Climate System Study (ACSYS). This dataset was used for the calculation of river flows into the Arctic Ocean as a contribution to ACSYS. For a description of the correction method, please refer to GRDC report No. 15. Furthermore, a plausibility control was applied on the time series of the 160 stations near the mouth of major rivers used for the calculation of the freshwater fluxes into the world's oceans in GRDC report No. 10.

The time series of monthly and daily values were displayed as a graph on the screen and visually controlled. Any irregularities which could be located in this way were examined in the raw data and, if possible, corrected. A correction was only made when the correct value could be reconstructed without any doubt, for example if a wrong order of digits or a missing zero was detected. No data gaps were filled. In most cases the data correction could be applied using the method of linear interpolation or manual correction.

As a result, a very low error rate was found in the time series.

Database technology

On the database server's side with the INFORMIX-database system running under UNIX, no major changes were made. On the other side, the operating system of the client's computers where the database query and evaluation software is performed, has been changed from DOS/Windows 3.x to Windows NT 4.0.

For 1998, initial steps are foreseen in the field of: migration of the database server to Windows NT, adaption of the clients software, realisation of an internet-access to defined subsets of the GRDC database (e.g. standard data set of 160 important stations, ACSYS data set) and the installation of an online-catalogue tool on the GRDC homepage which allows database catalogue queries directly on the GRDC-homepage via internet.

Data requests and user services

In 1997, a total of 91 requests for the GRDC database has been processed, which is the same number as in 1996. Using the categorization from the 1996 report, the following user profile results (see table 2).

Topic	Requests received 1997	Requests 1996
Hydrometeorological modelling	11	1
Operational hydrology	16	22
Regional/global hydrological issues	25	20
Climate and ocean related research	15	31
Information/advisory requests	19	12
Others	5	5
Total	91	91

Table 2: Categorization of the database requests for 1997 and 1996

Compared with 1996, some differences can be seen: a strong decrease of requests in the fields of climate/ocean related research and a slight decrease in operational hydrology was registered. Substantially more requests were received for hydrometeorological modelling, regional/gobal hydrological issues and information/advisory terms. For the future a rising number of information/advisory requests is expected due to the increase of GRDC's involvement in water-related activities of United Nations agencies, governmental advisory services and project-related consulting activities.

In most cases, a reaction time of a few days could be kept from the receipt of the final request to the delivery of the data. A detailed description of the database requests including the requesting researcher and/or institution and purpose of data use is given in annex 5. As an important part of improved user services, the line of standard data products has been substantially increased and

includes now also flow-duration curves, variability plots of discharge and distribution functions as well as basic statistics.

The Database Catalogue Tool, which is a user-friendly software for the query of the database contents, is now available in a 16-bit (Windows 3.x) and 32-bit (Windows ´95/NT) version. With both versions, a newly developed search tool is delivered together with the catalogue information. Figure 1 is a screen-dump of the database catalogue software, where the different selection criteria in the upper part of the window can be seen as well as an example catalogue query in the viewer below.

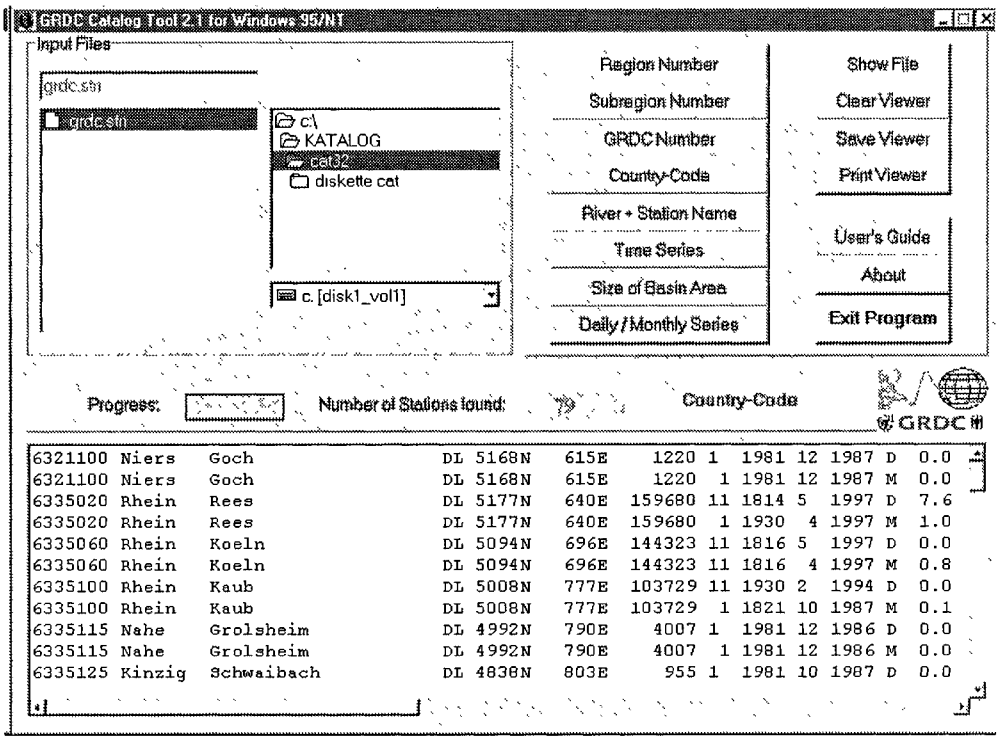


Figure 1: Screen-Dump of the Database Catalogue´s main window

Internet Homepage

With the installation of the web-server of the Federal Institute of Hydrology in 1997 the opportunity was given to set up a GRDC-homepage administered directly by GRDC/FIH. In August 1997, the GRDC homepage on the FIH-server became operational and has now (5/98) substituted the GRDC-pages on the Internet-server of the World Meteorological Organisation in Geneva. On the WMO server a link to the new homepage will remain, so that there will not be any changes for the user. As an advantage there will be a greater flexibility in operation and maintenance of the web page and a more timely access to updated catalogue information.

Since the page became operational in autumn 1997, 68 downloads of the GRDC database catalogue tool were registered until the end of the year 1997.

The new URL is: **http://www.bafg.de/grdc.htm**

A new ftp-server has been installed, where the GRDC database catalogue can be downloaded (32 bit version for Windows 95/NT) as a zipped file. The address is:

ftp://anonymous@www.bafg.de/pub/grdc/cat

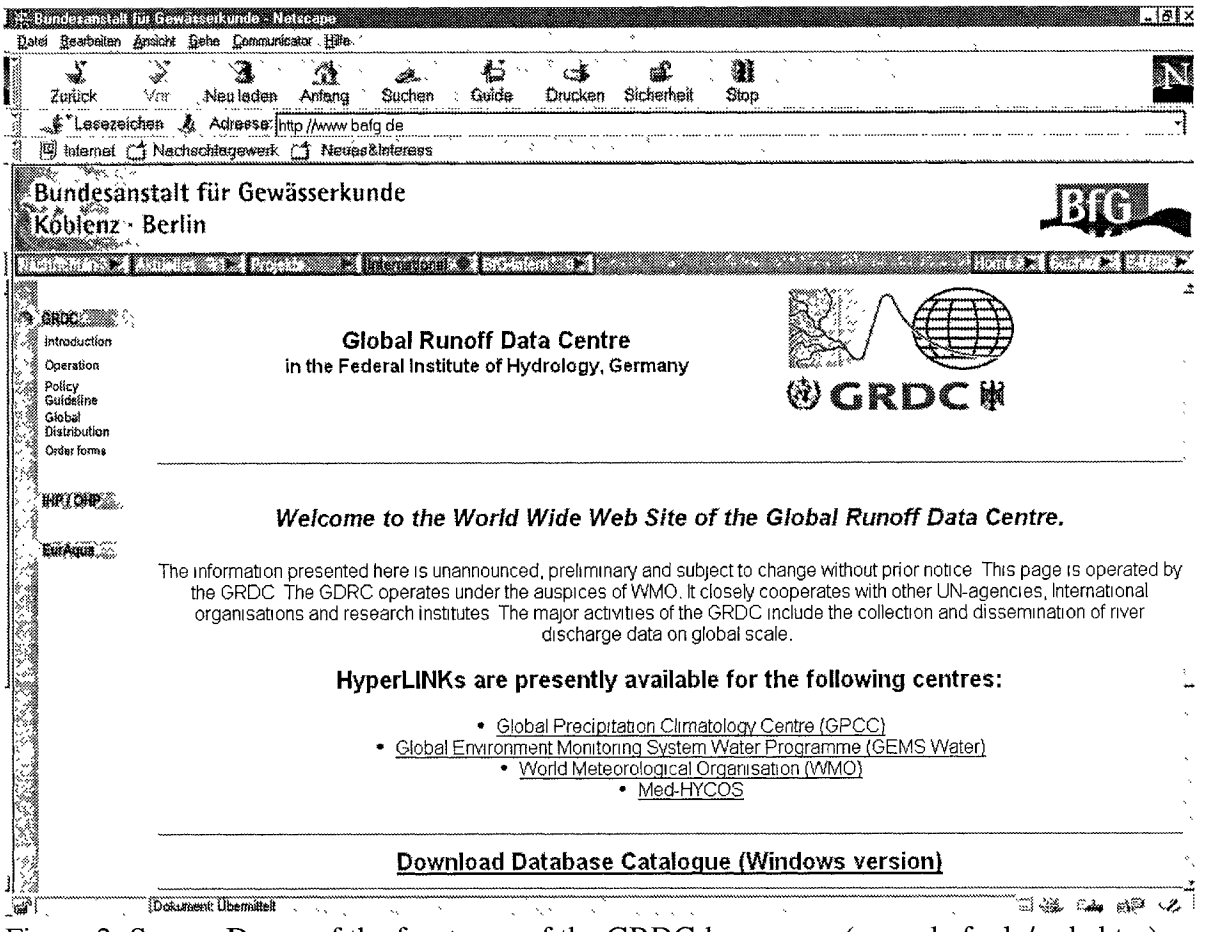


Figure 2: Screen-Dump of the frontpage of the GRDC-homepage (www.bafg.de/grdc.htm)

GRDC Brochure

Based on the success of the English version of the brochure and on request by francophone and spanish-speaking countries, WMO has in 1997 provided to GRDC translations of the text. GRDC will publish the brochure in French and Spanish by the end of 1998.

Research issues

As a contribution to the World Climate Programme Water (WCP-Water), the following three research projects are undertaken at the Federal Institute of Hydrology.

Transformation of measured runoff data to grid points

The final report of this project has been submitted to the responsible Ministry and an executive summary is being prepared in English. Using the Weser and Elbe (Labe) catchments in Germany, monthly discharge values for the period 1971 to 1980 have been computed on a grid net. A Geographic Information System (GIS) is used as a tool for the computation of gridded discharge data. Data input to the GIS consists of internationally available sources as well as of a digital elevation map of the cited catchments. The grid size can be customized up to 0.5 · 0.5° for projects in climatology and hydrology on regional and global scales. Though the results are encouraging, one of the methods being only based on measured discharge data requires a station density which is not available in many countries. Another method consists of a water balance model combined with measured discharge data of selected stations (see annex 6 for a more detailed abstract).

The development of a GIS-supported Water Balance Model as a Tool for the Validation of Climate Models and Hydrometeorological Datasets

In the ongoing study, a grid-based water balance model is proposed following the THORNTHWAITE-MATHER procedure to calculate long term mean monthly water balance components on a 0.5° grid. Discharge data are used in several steps for parameter estimation as well as for validation and verification of the water balance components. The water balance model has so far been applied for a 0.5° grid covering Central Europe. Model validation was carried out for the rivers Rhine, Weser, Ems, Elbe (Labe) and the German part of the River Danube for the period of 1971-1980. This work is continued (see annex 7 for a more detailed abstract).

Statistical evaluation of river discharge data

Using a series of well-established statistical methods for data analysis and time-series investigation, GRDC embarked on an exercise to publish statistical properties of rivers on a regional, continental and - where appropriate - global basis. Supplied on request together with the data, these analysis allow an assessment of river flow properties for users. In view of the interests of major data user groups such as hydrometeorological modelling as well as climate related research (i.e. validation of Global Circulation Models) a special focus is set on the analysis of trends, autocorrelation and jumps in the discharge time series.

The statistical package assembled for this purpose at the GRDC is based on the WCP-Water Project A.2 (Analyzing long time series of hydrological data and indices with respect to climate variability and change), a HOMS-component (Hydrological Operational Multipurpose System) of the Czech Hydrometeorological Institute (CHMI) and on a EU-fincanced project of the Ruhr-Universität Bochum (RUB) and may be modified as a result of feedbacks which are expected from the publication of the first cross-regional pilot report in August 1998. For more detailed information see annex 8.

Regional activities

GRDC's regional activities in 1997 were focused on WMO-Region II and included country missions (see above) and advisory services to several hydrological services and regional institutions such as ESCAP in Bangkok. As mentioned in the section on data aquisition above, GRDC views the strengthening of its regional activities linked to existing and emerging regional bodies as increasingly important.

Africa, being under-represented in the GRDC's regional activities needs an effort by GRDC to assist in capacity building i.e. in the context of SADC-HYCOS.

Steering Committe 1997 - major results

The third meeting of the Steering Committee convened from March, 25 to 27 in the Federal Institute of Hydrology in Koblenz, Germany. A commented member list of the Steering Committee is given in annex 9. A complete documentation of this meeting is given in the GRDC Report No. 17. As an coutcome of this Steering Committee meeting there are the following main results:

- Harmonization of the GRDC Policy Guidelines with the following recommendations and resolutions of WMO and UNESCO:
  - Draft Resolution of the Tenth Session of the Commission of Hydrology (Koblenz, December 1996) for the exchange of hydrological data, which was formulated in parallel to Resolution 40 (Cg-XII) for the exchange of meteorological data and which has subsequently been endorsed by EC-XLIX (June 1997)
  - Resolution of the Intergovernmental Council for the International Hydrological Programme (IHP) of UNESCO, which invites member states to review their exchange of hydrological data
- GRDC contributes to the World Climate Programme Water with mainly two projects and has the role of a key service provider for WCP-Water projects and other WCP-Programmes. The two projects are Project A.5 „Collection of Global Data Sets" and A.8 „Detecting Global and Regional Runoff Trends by Monitoring Discharges of Selected Rivers"
- Because WHYCOS has a great potential as a principal source of near real-time hydrological data for the GRDC, GRDC is requested to liaise with the WMO Secretariat and the regional HYCOS offices to establish an institutional data transfer to the GRDC. GRDC is already collaborating with Med-HYCOS and SADC-HYCOS
- The collaboration of the regional FRIEND-projects and the GRDC should be strengthened in terms of data exchange, noting also the Resolution of the Intergovernmental Council for the IHP of UNESCO. GRDC is actively involved in the FRIEND Hindu Kush Himalaya Project
- GRDC is of potential value for GTOS, but as a first step a clear definition of the data needs has to be made. Presently, 161 stations have been identified by GRDC which could serve as an initial step to global monitoring system in hydrology. GRDC is a member of the GTOS steering committee
- Facing the growing freshwater needs and the need for a global outlook on freshwater availability, it is high time to leave national boundaries in data exchange. Starting points

could be regional and global projects and the collaboration with regional economic and politic bodies. There is also a need to develop strategies to synthesize regional and global hydrological activities and exchange of data and information
- Amendment of the GRDC database with discharge and sediment database compiled by Milliman et al. for the IGBP/LOICZ project and the Global River Input (GLORI) database compiled by Meybeck with discharge, sediment load and selected chemical parameters
- The collaboration with the Continental Scale Experiments (CSE´s) of GEWEX should be intensified. One possible contribution of GRDC could be the statistical analysis of optimized runoff data sets delivered by the CSE´s
- GRDC will enhance its web-page with elements of electronic publishing and electronic access to certain data sets
- GRDC will intensify its research activities in collaboration with other institutions and visiting experts.

GRDC Policy Guidelines

The GRDC is the only data centre operating under the auspices of WMO that has a defined policy for the dissemination of data. During the Tenth Session of the WMO Commission for Hydrology in Koblenz (December 1996), a Draft Resolution for the exchange of hydrological data was prepared and later has been endorsed by the WMO Executive Council in May 1997 for review of the WMO congress in 1999. The GRDC guidelines for the dissemination of data and costing of services were harmonized to this resolution. The main principles of the guidelines were left unchanged: free and unrestricted access to the data for scientific purposes, costs only for the reproduction of the data, data will not be given to third parties without GRDC´s consent, data providers are recognized as owners of the data which implicitely carries the obligation to correct errors and to provide quality-controlled data and related information.

The revised guidelines are attached as annex 4.

Participation in major programmes and projects
WCP-Water

The World Climate Programme - Water (WCP-Water) consists of four major components which are the global atmosphere, the world oceans, the cryosphere and the land surface with its surface and groundwater runoff (see figure 3). The main contribution of the GRDC to this programme are two projects: Project A.5, „Collection of global runoff data sets“ and Project A.8, „Detecting global and regional runoff trends by monitoring discharges of selected rivers“. Furthermore, the GRDC is involved in Project A.2, „Analyzing long time series of hydrological data and indices with respect to climate variability and change“. In this respect, the use of statistical software packages, such as the software developed by WMO, was discussed during the meeting of the Steering Committee and has now been assembled for operational use by GRDC. Some amendments should be made with the currently implemented functions, others should be added. The 7th WCP-water planning meeting in 1997 already recommended to organize an experts´ workshop about possible amendments to this software package. This meeting is proposed to be

held at the Institute of Hydrology in Wallingford, UK in 1998/99.

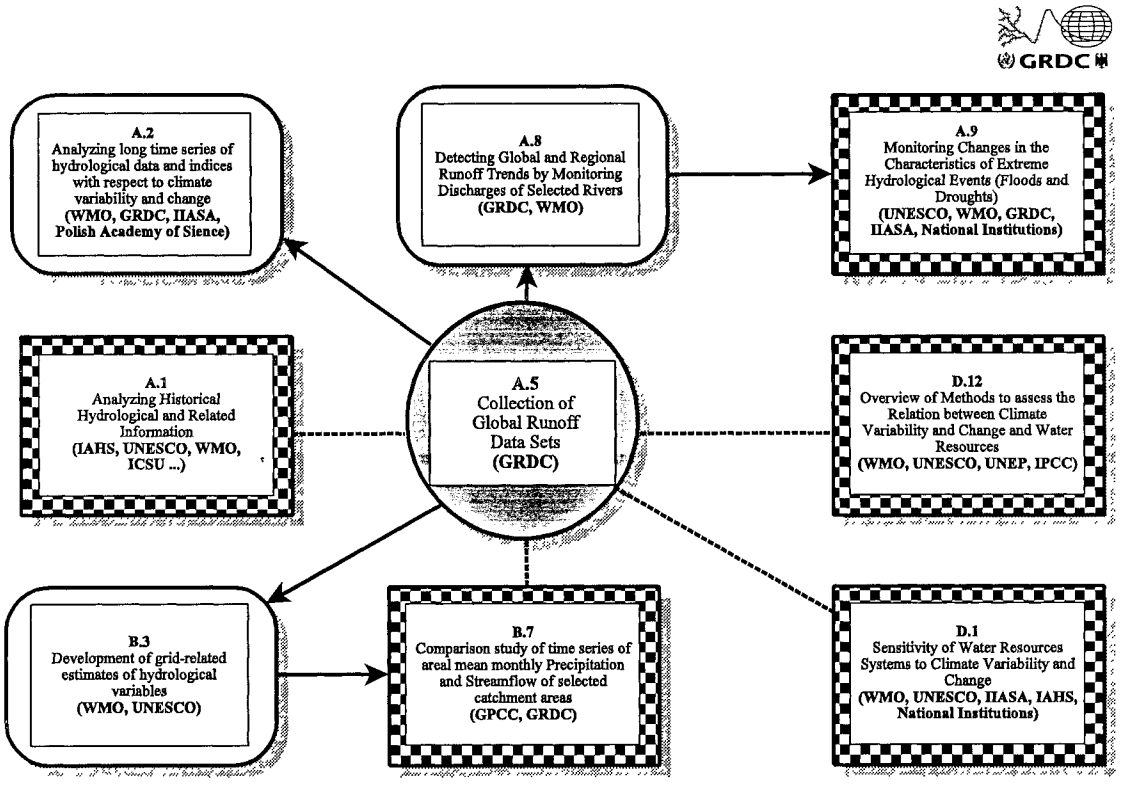


Figure 3: Liaison of the GRDC with other WPC Projects

WHYCOS

The World Hydrological Cycle Observing System (WHYCOS) is funded by WMO, the World Bank, the European Union and other agencies and is organized in regional projects. The objective of WHYCOS is to provide a scientific basis for water resources monitoring, assessment and integrated water resources development and management at different scales. As a contribution to the knowledge of hydrological processes in their interaction with climate and the environment it will encourage sharing of hydrological data and information. It is expected that WHYCOS with its several regional projects may become one of the most important providers of near real-time hydrological data for the GRDC. Therefore it is important to take part as early as possible in the regional HYCOS projects. On the other hand, an important benefit for WHYCOS may consist of the ability of the GRDC to form a link between the regional activities, which is necessary for a hydrological network operating on a global scale.

Presently, GRDC is involved in one regional HYCOS project which is in an advanced stage of implementation: Med-HYCOS, the Mediterranean project of WHYCOS. In the Mediterranean region 23 riparian countries are involved in the Med-HYCOS Project (Mediterranean Hydrological Cycle Observing System) which is one regional part of WHYCOS. One of the objectives of Med-HYCOS is to build up a database with near-real time hydrometeorological

data including river discharge data. As data sources there are up to now 20 recently delivered data collection platforms with Meteosat-transmission capability as well as the already existing gauging stations.

In 1997, the collaboration between GRDC and Med-HYCOS was strengthened in the fields of database technology and data exchange. Med-HYCOS may become, together with the other regional HYCOS-projects, one of the most important providers of near-real time hydrological data. In 1997, GRDC took part in two meetings of Med-HYCOS - the meeting of the Initial Coordinating Group in Metkovic/Croatia and in the Meeting of the Regional Task Force 4 in Montpellier. Two scientists of ORSTOM, which is together with other agencies responsible for the implementation of Med-HYCOS, visited the GRDC. As a result, an agreement was set up about the collaboration and data exchange between GRDC and the Med-HYCOS regional data base. Furthermore, GRDC visited ORSTOM to intensify the collaboration in the field of database technology and data management.

GRDC expects to become actively involved in the SADC-HYCOS project which will be launched later in 1998.

UNESCO-FRIEND

The UNESCO-FRIEND project from UNESCO (Flow Regimes from International and Experimental Network Data) is organised in several regional sub-projects. Although the focus for the data collection is on smaller catchments with a minimum of anthropogenic influence, there are some overlaps with GRDC data collection activities.

Data generated within the several FRIEND projects are restricted to members of the established FRIEND working groups and generally not accessible for others. Each regional FRIEND-project is responsible for its own data holding and for the possible access to the data. An example for this is FRIEND Northern Europe. GRDC has attained the role as data manager for Germany, Switzerland and Austria. The cooperation between GRDC and FRIEND is accentuated inter alia by the participation and involvment of GRDC and FRIEND in its respective Steering Committees and informal consultations.

From the viewpoint of GRDC, there is a need to establish a framework for data exchange between regional FRIEND projects and GRDC. In any case, FRIEND data which are published in yearbooks or published in electronic format should be made accessible to GRDC.

For the recently established FRIEND-project for the Hindu Kush Himalaya region (HKH-FRIEND), GRDC has responsibilities for the implementation of the regional database. The HKH-FRIEND is the first one where WMO/GRDC is directly involved together with UNESCO with the generous assistance of the German National IHP/OHP Committee.

GTOS / GCOS

The main objective of GTOS, the Global Terrestrial Observing System, as given in the GTOS

mission statement, is to provide policy makers, resource managers and researchers with access to the data needed to detect, quantify, locate, understand and warn of changes (especially reductions) in the capacity of terrestrial ecosystems to support sustainable development. It is of importance for the GRDC that GTOS is promoting the exchange of data and applications.

Being represented in the GTOS Steering Committee, GRDC assists in the programme development of GTOS and promotes its aims and objectives. GRDC has offered GTOS to use its hydrological database, especially for global monitoring of the discharge situation. GRDC could assist GTOS in analyzing long term time series of discharge data. Up to now, 161 stations in the GRDC databases have been identified as appropriate for this task.

Regarding GCOS, the Global Climate Observing System, no specific actions were carried out by GRDC in 1997.

ACSYS

The main objective of the ACSYS hydrology programme is to develop, test and refine macro-scale hydrological models which could be used to represent the essential continental link in the climatic feedback loop between the global atmospheric circulation, rainfall and evaporation, on the one hand, and the fresh water discharge from the Arctic Rivers to the Arctic Ocean, on the other hand.

In order to provide impetus for the collection of the required hydrological information for ACSYS, GRDC, on behalf of ACSYS, organises the international hydrological data exchange through a special Arctic Runoff Database (ARDB). Initially, only 15 stations were mentioned regarding the ARDB in the ACSYS Science Plan (1992), but up to now the database developed much more. The ARDB contains information of gauging stations of presently 233 rivers draining into the Arctic Ocean at gauge sites were hydrological observations were made or are made. ARDB is a separate project on behalf of ACSYS implemented within the GRDC using the same technical facilities.

In 1997, no official data from the countries participating in ACSYS were received by GRDC. For the future, there is a need to pursue an institutionalized transfer of hydrological data from the national hydrological agencies to the GRDC. Recognizing this situation, the ACSYS Steering Committee has planned an ad-hoc meeting in early 1998 to review the use of the ARDB.

GRDC is co-chairing the Data Management and Information Panel (DMIP) of ACSYS. The first meeting of this panel has been planned for early 1998 with the objective to produce a data and information directory as a first step for a comprehensive ACSYS Data Managment and Information Plan.

GEWEX Hydrometeorological Panel (GHP)

GRDC is an ex-officio member of the GHP. The collaboration between GHP and the GRDC

needs to be strengthened, especially regarding the CSE´s (Continental Scale Experiments). It is expected that the CSE´s needs for hydrological data will increase in the next years and more requests for hydrological data will be received by the GRDC. On the other hand, GRDC expects also contributions of CSE´s to the GRDC database. During the third session of the GEWEX-GHP meeting in Sapporo in December 1997, the role of the CSE´s in providing datasets which can be used i.e. for the validation of climate or hydrometeorological models and remote sensing applications was dicussed.

One more possible contribution of the GRDC for the CSE´s lies in the activities of the GRDC in the WCP-Water project A.8 (Detecting Global and Regional Runoff Trends by Monitoring Discharges of Selected Rivers).

INTAS

GRDC cooperates with the Institute of Hydrology, Wallingford in a joint project to strengthen the data managment of Russia, Belo-Russia and the Ukraine. The project is in its second year out of a project duration of three years. To promote data acquisition, managment and dissemination in this project, GRDC participated in a high-level project meeting in Kiev, Ukraine.

GEMS/Water

The Global Environment Monitoring System (GEMS/Water) of UNEP/WHO operates the global database for water quality data at the National Water Research Institute in Ontario/Canada. GEMS/Water intends to establish the GEMS/GLORI database (Global River Pollutant Discharges to Oceans) created by Meybeck, which contains discharge, sediment load and selected chemical parameters, at the GRDC as a step to link data and information for water quantity and quality. During the Session of the GRDC Steering Committee the committee recommended to transfer the discharge and sediment database compiled by Milliman et al. for the IGBP/LOICZ project (International Geosphere/Biosphere Project / Land-Ocean Interaction in the Coastal Zone) to the GRDC. More concerted activities are expected to follow under a renewed thrust for GEMS/Water and in particular for UNEP as a consequence of present developments within the UN System.

Visits to the GRDC

In 1997, GRDC welcomed visitors from the following institutions:
- Lamont-Doherty Earth Observatory of Columbia University, USA
- National Water Research Institute, Canada
- Disaster Prevention Research Institute, Water Resources Research Center, Kyoto University, Japan
- Institute for Water Research, Rhodes University, Grahamstown, South Africa
- National Oceanic and Atmospheric Administration (NOAA), USA
- International Institute for Infrastructural, Hydraulic and Environmental Engineering Delft,

The Netherlands
- Gesellschaft für technische Zusammenarbeit, Eschborn, Germany
- Centro Interamericano de Desarrollo e Investigaciòn Ambiental y Territorial, Mérida, Venezuela
- ORSTOM (L'Institut français de recherche scientifique pour le développement en coopération), France.

New GRDC Reports

In 1997, the following five reports have been published.

Report No. 13 (February 1997) is the GRDC Status Report 1996. For the future (starting 1998), GRDC intends to change the yearly rhythm for the Status report into a two-year rhythm, combined with the sessions of the Steering Committee. Interim news will be made available on the GRDC web site.

Report No. 14 (February 1997): The use of GRDC-information, Review of data use 1993/94 - Status January 1997. This report contains abstracts of research projects which have been undertaken by using data of the GRDC. 56 % of all users did answer to a questionnaire requesting information about their project. The lagtime of 2-3 years between the original request and this report was choosen because the typical duration of a research project is 2-3 years.

Report No. 15 (June 1997): Third Interim Report on the Arctic River Database (ARDB) for the Arctic Climate System Study (ACSYS): Plausibility Control and Data Corrections (Technical Report). This short report includes a description of methods and results of the plausibility control applied on the set of 35 ACSYS-stations which were used for the calculation of the river runoff into the Arctic Ocean.

Report No. 16 (August 1997): The GRDC database. Concept and Implementation. This report contains a detailed description of the database technology as well as of the dataflow, import/export routines, administrative tools and corresponding evaluation software used in the GRDC.

Report No. 17 (September 1997): Report on the Third Meeting of the GRDC Steering Committee, Koblenz, Germany, June 25-27, 1997.

For a recent list of GRDC-reports, see annex 10.

Annexes

Update List 1997

Country	Date	GRDC-No.	River	Station	from-to	Daily Monthly	New Update
Australia	26.01.1998	5101020	Pascoe River	Garraway Creek Junc.	1970-1996	D/M	U
Ecuador	22.05.1997	3819150	Coca	San Rafael	1982-1982	M	U
	22.05.1997	3844400	Daule	La Capilla	1989-1994	D	U
	22.05.1997	3844400	Daule	La Capilla	1982-1994	M	U
	22.05.1997	3843100	Mira	D.J. Lita	1973-1988	M	U
	22.05.1997	3844300	Quevedo	Quevedo	1982-1994	D	U
	22.05.1997	3844300	Quevedo	Quevedo	1982-1994	M	U
	22.05.1997	3844450	Vinces	Vinces	1989-1994	D	U
	22.05.1997	3844450	Vinces	Vinces	1973-1994	M	U
	22.05.1997	3822100	Pastaza	Banos	1989-1990	D	U
	22.05.1997	3822100	Pastaza	Banos	1978-1990	M	U
	22.05.1997	3844800	Jubones	D.J. San Francisco	1987-1994	D	U
	22.05.1997	3844800	Jubones	D.J. San Francisco	1972-1994	M	U
	22.05.1997	3846500	Calera	A.J. Amarillo	1972-1988	M	U
	22.05.1997	3819100	Quijos	D.J. Oyacachi	1982-1992	D	U
	22.05.1997	3819100	Quijos	D.J. Oyacachi	1979-1992	M	U
	22.05.1997	3843500	Ambi	D.J. Cariyacu	1989-1994	D	U
	22.05.1997	3843500	Ambi	D.J. Cariyacu	1973-1994	M	U
	22.05.1997	3844100	Esmeraldas	D.J. Sade	1989-1991	D	U
	22.05.1997	3844100	Esmeraldas	D.J. Sade	1972-1991	M	U
	22.05.1997	3844200	Toachi	A.J. Pilaton	1989-1993	D	U
	22.05.1997	3844200	Toachi	A.J. Pilaton	1973-1993	M	U
	22.05.1997	3844150	Granobles	A.J. Guachala	1989-1994	D	U
	22.05.1997	3844150	Granobles	A.J. Guachala	1971-1994	M	U
	22.05.1997	3844460	Zapotal	Catarama	1982-1994	D	N
	22.05.1997	3844460	Zapotal	Catarama	1982-1994	M	N

Country	Date	GRDC-No.	River	Station	from-to	**D**aily **M**onthly	**N**ew **U**pdate
	22.05.1997	3844465	Zapotal	Lechugal	1982-1994	D	N
	22.05.1997	3844465	Zapotal	Lechugal	1965-1994	M	N
	22.05.1997	3822600	Tomebamba	Monay	1982-1994	D	N
	22.05.1997	3822600	Tomebamba	Monay	1964-1994	M	N
	22.05.1997	3822650	Matadero	Sayausi	1982-1994	D	N
	22.05.1997	3822650	Matadero	Sayausi	1964-1994	M	N
Germany	21.05.1997	6342900	Danube	Achleiten	1900-1991	D/M	U
	21.05.1997	6342800	Danube	Hofkirchen	1900-1994	D/M	U
	21.05.1997	6342500	Danube	Ingolstadt	1975-1987	D/M	U
	21.05.1997	6342200	Iller	Kempten	1975-1987	D/M	U
	21.05.1997	6343100	Inn	Wasserburg	1826-1980	D	U
	21.05.1997	6343900	Inn	Passau-Ingling	1920-1989	D/M	U
	21.05.1997	6343500	Salzach	Burghausen	1826-1989	D/M	U
	02.07.1997	6357500	Odra	Eisenhüttenstadt	1988-1996	D/M	U
	02.07.1997	6357010	Odra	Hohensaaten-Finow	1990-1996	D/M	N
	02.07.1997	6335020	Rhein	Rees	1996-1997	D/M	U
	02.07.1997	6335060	Rhein	Köln	1992-1997	D/M	U
Greece	29.01.1997	6261300	Aliakmon	Ilarion	1962-1988	M	U
	29.01.1997	6261100	Aracthos	Tsimovo	1964-1980	M	U
	29.01.1997	6261200	Acheloos	Avlaki	1985-1991	M	U
	29.01.1997	6264100	Nestos	Temenos	1965-1990	M	N
	29.01.1997	6261310	Almopaios	Prof. Ilias	1988-1995	M	N
	29.01.1997	6260100	Aoos	Konitsa	1963-1987	M	N
	29.01.1997	6261400	Kalamas	Kioteki	1963-1978	M	N
	29.01.1997	6261250	Portaikos	Pyle	1985-1994	M	N
	29.01.1997	6261260	Pamisos	Moyzaki	1988-1995	M	N
	29.01.1997	6262100	Asopos	Platani	1985-1993	M	N
Guyana	17.11.1997	3308300	Mazaruniat	Apaikwa	1987-1995	D	U
	17.11.1997	3308100	Barima	Eclipse Falls	1981-1986	D	U

Country	Date	GRDC-No.	River	Station	from-to	**D**aily **M**onthly	New **U**pdate
	17.11.1997	3308400	Cuyuna	Kamaria Falls	1987	D	U
	17.11.1997	3308600	Essequibo	Plantain Island	1991-1995	D	U
	17.11.1997	3309300	Demerara	Great Falls	1991-1995	D	U
	17.11.1997	3309700	Canje	Reynold's Bridge	1987-1995	D	U
Hungary	04.02.1997	6442050	Raba	Szentgotthard	1992-1995	D/M	U
	04.02.1997	6442200	Marcal	Rabaszentmiklos	1990-1995	D/M	U
	04.02.1997	6442300	Kapos	Kurd	1992-1995	D/M	U
	04.02.1997	6442450	Danube	Dunaalmas	1992-1995	D/M	U
	04.02.1997	6442500	Danube	Nagymaros	1992-1995	D/M	U
	04.02.1997	6442600	Danube	Mohacs	1992-1995	D/M	U
	04.02.1997	6444090	Tisza	Tiszabecs	1991-1995	D/M	U
	04.02.1997	6444100	Tisza	Szeged	1992-1995	D/M	U
	04.02.1997	6444110	Maros	Mako	1992-1995	D/M	U
	04.02.1997	6444200	Tisza	Szolnok	1992-1995	D/M	U
	04.02.1997	6444250	Zagyva	Jasztelek	1992-1995	D/M	U
	04.02.1997	6444310	Tisza	Tiszapalkonya	1992-1995	D/M	U
	04.02.1997	6444350	Bodva	Szendro	1992-1995	D/M	U
	04.02.1997	6444380	Sajo	Felsozsolca	1992-1995	D/M	U
	04.02.1997	6444400	Feher-Koros	Gyula	1992-1995	D/M	U
	04.02.1997	6444500	Kraszna	Agerdomajor	1992-1995	D/M	U
	04.02.1997	6444600	Szamos	Csenger	1992-1995	D/M	U
Israel	29.01.1997	6593700	Soreq	Near Gedera	1960-1992	D	U
	29.01.1997	6593500	Alexander	Alyashiv	1967-1993	D	U
	29.01.1997	6593800	Be'er Sheva	Near Hatserim	1988-1993	D	U
	29.01.1997	6594050	Jordan	Obstacle Bridge	1988-1993	D	U
	29.01.1997	6594070	Jordan	Sede Nehemya	1984-1992	D	N
	29.01.1997	6594080	Jordan	Naharyim	1988-1993	D	N
Italy	10.11.1997	6349200	Adige	Bronzolo	1975-1990	D/M	U
	10.11.1997	6349300	Adige	Trento	1955-1981	D/M	N

Country	Date	GRDC-No.	River	Station	from-to	Daily Monthly	New Update
Mekong Basin	07.01.1998	2469055	Se Kong	Attopeu	1992-1993	D	U
	07.01.1998	2469300	Nam Lik	Ban-Hin Heup	1992-1993	D	U
	07.01.1998	2469049	Nam Khan	Ban Mixay (Ban Mout)	1990-1993	D	U
	07.01.1998	2469057	Nam Ngum	Ban-Na Luong	1988-1993	D	U
	07.01.1998	2469058	Nam Ngum	Ban-Pak Kauhuoung	1992-1993	D	U
	07.01.1998	2469111	Nam Theun	Ban-Signo	1988-1993	D	U
	07.01.1998	2469082	Nam Chi	Ban Chot	1988-1993	D	U
	07.01.1998	2969210	Lam Dom Yai	Ban Fang Phe	1992-1993	D	U
	07.01.1998	2969116	Huai Khayung	Ban Huai Khayung	1992-1993	D	U
	07.01.1998	2469120	Se Bang Hieng	Ban Keng Done	1990-1993	D	U
	07.01.1998	2969115	Nam Yang	Ban Na Thom	1992-1993	D	U
	07.01.1998	2969081	Huai Rai	Ban Nong Kiang	1988-1993	D	U
	07.01.1998	2969069	Nam Heung	Ban Pak Huai	1992-1993	D	U
	07.01.1998	2969029	Nam Mae Lao	Ban Tha Sai	1988-1993	D	U
	07.01.1998	2369900	Ea Krong	Cau-14	1992-1993	D	U
	07.01.1998	2969010	Mekong	Chiang Saen	1992-1993	D	U
	07.01.1998	2969220	Nam Mun	Kaeng Saphu Tai	1992-1993	D	U
	07.01.1998	2469110	Se Champhone	Kengkok	1988-1993	D	U
	07.01.1998	2369800	Dak Bla	Kontum	1988-1993	D	U
	07.01.1998	2469050	Mekong	Luang Prabang	1992-1993	D	U
	07.01.1998	2469095	Se Bang Fai	Mahaxai	1992-1993	D	U
	07.01.1998	2969100	Mekong	Mukdahan	1992-1993	D	U
	07.01.1998	2469060	Nam Ou	Muong Ngoy	1992-1993	D	U
	07.01.1998	2469096	Nam Kam	Na-Kae	1992-1993	D	U
	07.01.1998	2969095	Mekong	Nakhon-Phanom	1988-1993	D	U
	07.01.1998	2969090	Mekong	Nong Khai	1992-1993	D	U
	07.01.1998	2469260	Mekong	Pakse	1988-1993	D	U
	07.01.1998	2969124	Nam Mun	Rasi Salai	1988-1993	D	U
	07.01.1998	2969076	Nam Pong	Si Chomphu	1988-1993	D	U
	07.01.1998	2469265	Se Done	Souvanna Khili	1988-1993	D	U
	07.01.1998	2969030	Nam Mae Ing	Thoeng	1988-1993	D	U

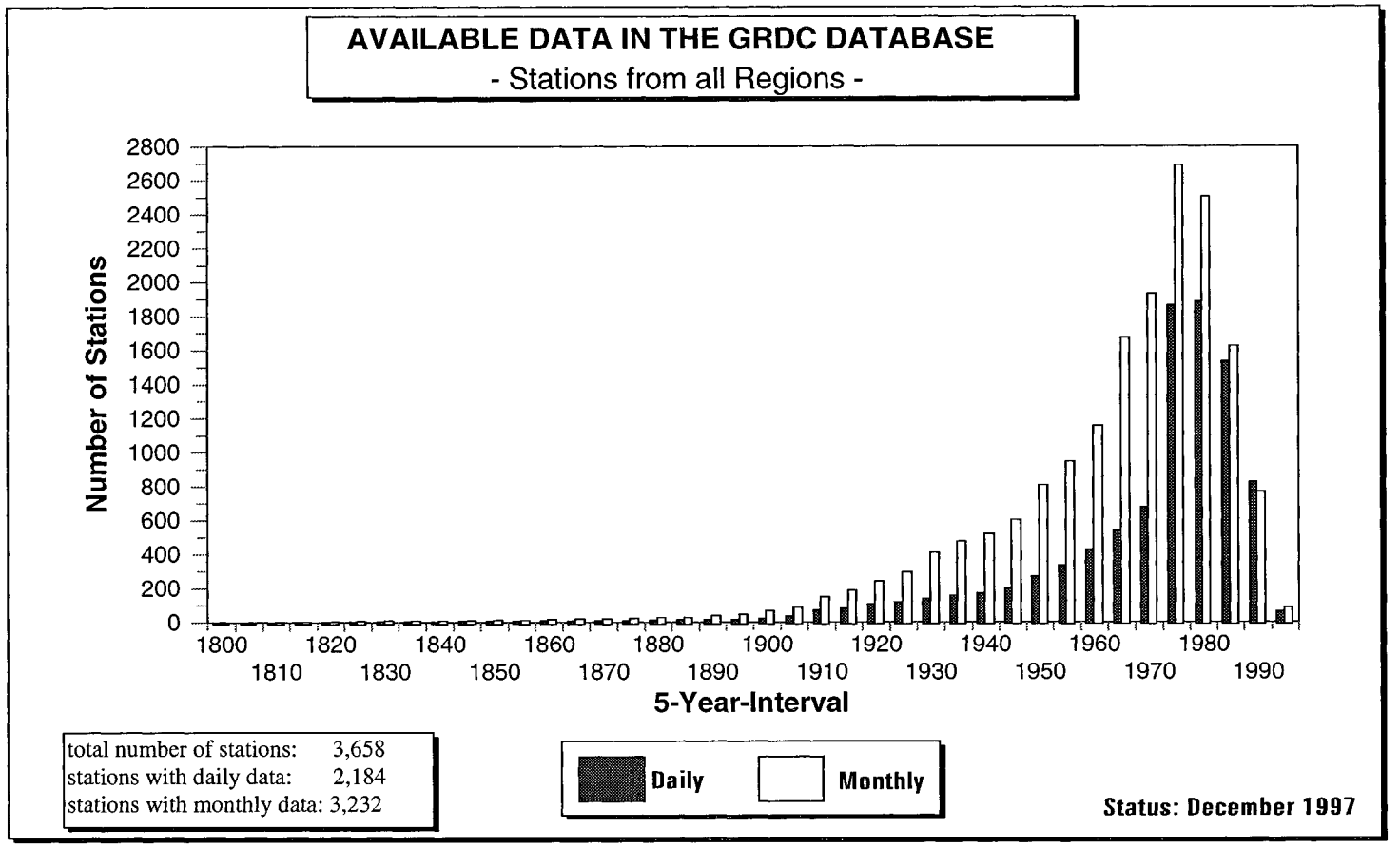
Country	Date	GRDC-No.	River	Station	from-to	**D**aily **M**onthly	**N**ew **U**pdate
	07.01.1998	2969200	Nam Mun	Ubon	1992-1993	D	U
Nepal	29.01.1997	2550110	Tamakosi	Busti	1971-1985	M	U
	29.01.1997	2548400	Karnali River	Chisapani	1962-1993	M	U
	29.01.1997	2548310	Jhimruk Khola	Tigra Gaon	1972-1977	M	U
	29.01.1997	2548460	Karnali River	Asara Ghat	1962-1993	M	N
	29.01.1997	2548450	Karnali River	Benighat	1963-1993	M	N
	29.01.1997	2548500	Bheri	Jamu	1963-1993	M	N
	29.01.1997	2548550	Babai	Bargadha	1967-1986	M	N
	29.01.1997	2548350	Mari Khola	Nayagaon	1964-1985	M	N
	29.01.1997	2548610	Rapti	Bagasoti Gaon	1976-1985	M	N
	29.01.1997	2548620	Rapti	Jalkundi	1964-1985	M	N
	29.01.1997	2549300	Kali Gandaki	Setibeni	1962-1993	M	N
	29.01.1997	2549350	Kali Gandaki	Kotagaon Shringe	1964-1985	M	N
	29.01.1997	2549400	Seti	Phoolbari	1964-1984	M	N
	29.01.1997	2549235	Burhi Gandaki	Arughat	1964-1985	M	N
	29.01.1997	2549500	Narayani	Devghat	1963-1993	M	N
	29.01.1997	2550200	Arun River	Turkeghat	1976-1986	M	N
	29.01.1997	2550300	Bhote Kosi	Barabise	1965-1985	M	N
	29.01.1997	2550400	Sunkosi	Pachuwar Ghat	1964-1985	M	N
	29.01.1997	2550350	Dudh Kosi	Rabuwar Bazar	1964-1985	M	N
	29.01.1997	2550450	Sunkosi	Kampughat	1966-1985	M	N
	29.01.1997	2550500	Tamur River	Mulghat	1965-1986	M	N
	29.01.1997	2550600	Sapta Kosi	Chatara-Kothu	1977-1985	M	N
	29.01.1997	2549225	Bagmati	Sundarijal	1991-1993	M	N
Netherlands	02.07.1997	6435060	Rhein	Lobith	1990-1996	D/M	U
Northern Territory	27.01.1998	5708125	East Baines River	Victoria Highway	1963-1997	D/M	N
	27.01.1998	5708126	West Baines River	Victoria Highway	1961-1996	D/M	N
	27.01.1998	5708110	Victoria River	Coolibah Homestead	1967-1996	D/M	U
	27.01.1998	5708145	Daly	Mount Nancar	1969-1996	D/M	U

Country	Date	GRDC-No.	River	Station	from-to	**D**aily **M**onthly	**N**ew **U**pdate
	27.01.1998	5708160	Adelaide River	Dirty Lagoon	1962-1996	D/M	N
	27.01.1998	5708185	Mary River	Mount Bundy	1956-1996	D/M	N
	27.01.1998	5709100	Roper River	Red Rock	1966-1996	D/M	N
	27.01.1998	5709110	MacArthur River	Mim Pump	1969-1996	D/M	N
Queensland	26.01.1998	5101070	Normanby River	Battle Camp Cross.	1967-1996	D/M	N
	26.01.1998	5101060	Jeannie River	Wakooka Road	1970-1988	D/M	U
	26.01.1998	5101080	Daintree River	Bairds	1968-1996	D/M	U
	26.01.1998	5101111	Mulgrave River	Gordonvale	1916-1988	D/M	N
	26.01.1998	5101116	Russell River	Bucklands	1938-1994	D/M	N
	26.01.1998	5101117	N. Johnstone River	Goondi	1928-1968	D/M	N
	26.01.1998	5101118	S. Johnstone River	Central Mill	1916-1996	D/M	U
	26.01.1998	5101130	Tully River	Buramo	1972-1994	D/M	U
	26.01.1998	5101161	Herbert River	Ingham	1915-1996	D/M	N
	26.01.1998	5101201	Burdekin	Home Hill	1921-1957	D/M	N
	26.01.1998	5101301	Fitzroy	The Gap	1964-1997	D/M	U
	26.01.1998	5101381	Mary River	Miva	1910-1996	D/M	N
	26.01.1998	5109110	Gregory River	Gregory Downs	1969-1996	D/M	N
	26.01.1998	5109170	Gilbert River	Rockfields	1967-1996	D/M	N
	26.01.1998	5109200	Mitchell River	Koolatah	1972-1996	D/M	N
Russian Federation	28.01.1997	6970100	Onega	Porog	1989-1993	M	U
	28.01.1997	6970150	Vonguda	Vonguda	1989-1993	M	U
	28.01.1997	6970120	Kodina	Kodina	1989-1993	M	N
	28.01.1997	6971750	Nenkosa	Nenkosa	1989-1992	M	U
	28.01.1997	6970250	Northern Dvina	Ust-Pinega	1989-1993	M	U
	28.01.1997	6970550	Kuloy	Kuloy	1989-1991	M	U
	28.01.1997	6970500	Mezen	Malonisogorskaya	1989-1993	M	U
	28.01.1997	6970560	Peza	Igumnovo	1989-1993	M	U
	28.01.1997	6970630	Pesha	Volokovaya	1989-1993	M	U
	28.01.1997	6970710	Pechora	Oksino	1989-1993	M	U
	28.01.1997	2912600	Ob	Salekhard	1989-1994	M	U

Country	Date	GRDC-No.	River	Station	from-to	**D**aily **M**onthly	New **U**pdate
	28.01.1997	2999500	Pur	Samburg	1989-1990	M	U
	28.01.1997	2999250	Taz	Sidorovsk	1989-1994	M	U
	28.01.1997	2909150	Yenisei	Igarka	1989-1995	M	U
	28.01.1997	2903420	Lena	Kusur	1989-1994	M	U
	28.01.1997	2903430	Lena	Stolb	1989-1994	M	U
	28.01.1997	2999850	Khatanga	Khatanga	1989-1991	M	U
	28.01.1997	2903150	Anabar	Saskylakh	1989-1994	M	U
	28.01.1997	2999920	Olenek	Sukhana	1989-1994	M	U
	28.01.1997	2998110	Yana	Ubileynaya	1989-1994	M	U
	28.01.1997	2998400	Indigirka	Vorontsovo	1989-1994	M	U
	28.01.1997	2998450	Alazeja	Andrushkino	1989-1993	M	U
	28.01.1997	2998150	Omoloy	Namu	1989-1993	M	U
	28.01.1997	2998510	Kolyma	Kolymskaya	1989-1994	M	U
	28.01.1997	2998800	Paljavaam	Paljavaam	1989-1995	M	U
Slovenia	13.11.1997	6545050	Sava	Catez	1956-1994	D/M	N
	13.11.1997	6545190	Sava	Radovljica	1945-1994	D/M	N
	13.11.1997	6545200	Krka	Podbocje	1933-1994	D/M	N
	13.11.1997	6545300	Savinja	Veliko Sirje	1955-1994	D/M	N
	13.11.1997	6545400	Ljubljanica	Moste	1946-1994	D/M	N
	13.11.1997	6546610	Mura	Gornja Radgona	1946-1994	D/M	N
	13.11.1997	6549180	Soca	Log Cezsoski	1950-1994	D/M	N
South Australia	27.01.1998	5402101	Drain L	Site A	1971-1996	D/M	N
	27.01.1998	5402100	Blackford Drain	Amtd 4.0 km	1971-1996	D/M	N
	27.01.1998	5402102	Drain M	Amtd 5.1 km	1971-1996	D/M	N
	27.01.1998	5402110	Reedy Creek	7.2 km NNE of South End	1971-1996	D/M	N
	27.01.1998	5404270	Murray	Overland Corner	1985-1996	D/M	N
	27.01.1998	5405100	Hindmarsh River	Hindmarsh Valley	1969-1997	D/M	N
	27.01.1998	5405105	Inman River	Upstream STW	1995-1997	D/M	N
	27.01.1998	5405031	Onkaparinga River	Clarendon Weir	1937-1997	D/M	N
	27.01.1998	5405041	Torrens River	Holbrooks Road	1978-1997	D/M	N

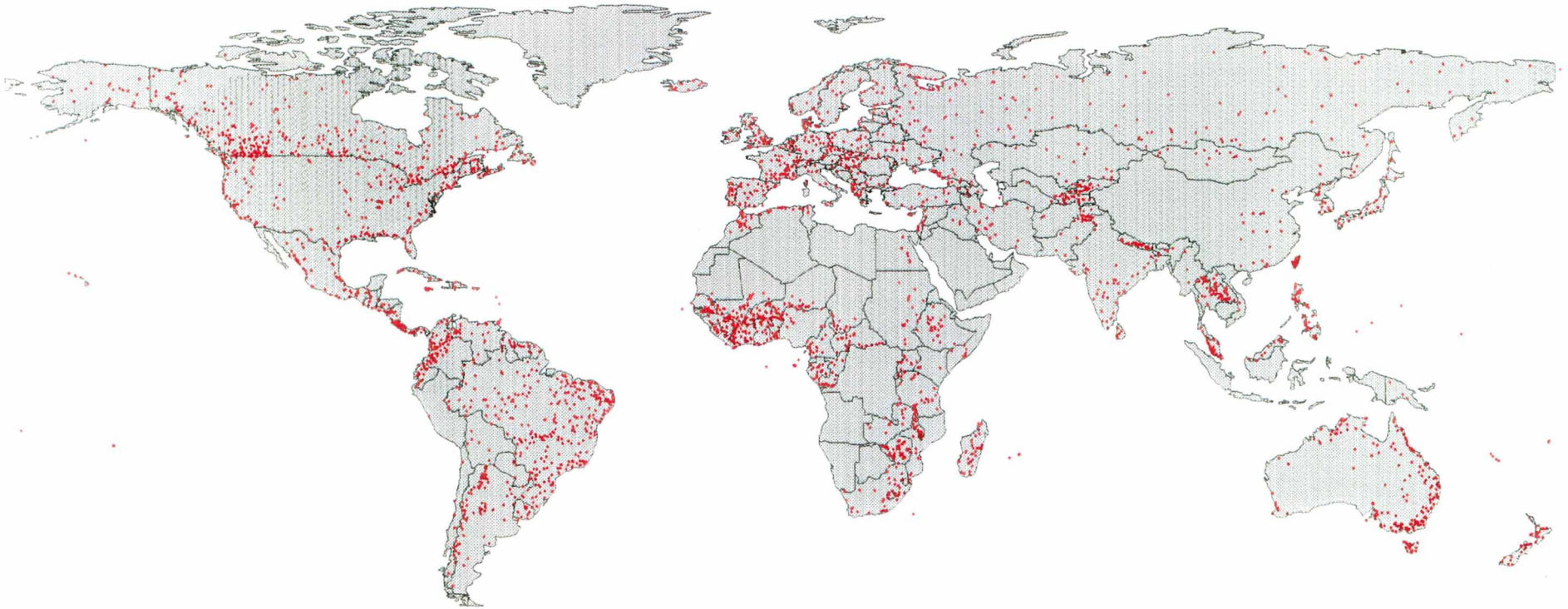
Country	Date	GRDC-No.	River	Station	from-to	**D**aily **M**onthly	**N**ew **U**pdate
	27.01.1998	5405046	Sturt River	D/S Anzac Highway	1990-1997	D/M	N
	27.01.1998	5405048	Brownhill Creek	Adelaide Airport	1993-1997	D/M	N
	27.01.1998	5405130	Rocky River	Gorge Falls	1973-1997	D/M	U
Trinidad & Tobago	08.01.1998	4186900	Courland	Courland	1974-1992	D/M	N
	08.01.1998	4186100	Caroni	Caroni Kelly	1967-1982	D/M	N
	08.01.1998	4186200	Matura	N. Oropuche	1975-1994	D/M	N
	08.01.1998	4186300	South Oropuche	S. Oropuche	1967-1982	D/M	N
	08.01.1998	4186400	Ortoire	Ortoire	1967-1994	D/M	N
United Kingdom	27.01.1997	6604650	Spey	Boat o Brig	1993-1994	D	U
	27.01.1997	6604750	Tweed	Norham	1993-1994	D	U
	27.01.1997	6605550	Wharf	Flint Mill Weir	1993-1994	D	U
	27.01.1997	6606400	Bedford Ouse	Bedford	1993-1994	D	U
	27.01.1997	6606900	Waveney	Needham Mill	1993-1994	D	U
	27.01.1997	6607200	Exe	Thorverton	1993-1994	D	U
	27.01.1997	6607150	Taw	Umberleigh	1993-1994	D	U
	27.01.1997	6604800	Dee	Woodend	1993-1994	D	U
	27.01.1997	6604610	Tay	Ballathie	1993-1994	D	U
	13.11.1997	6549100	Soca	Solkan	1945-1994	D/M	N
Uruguay	06.01.1997	3469050	Ururguay	Salto	1992-1994	D	U
	06.01.1997	3458200	Arroyo San Carlos	San Carlos	1983-1994	D/M	N
	06.01.1997	3471200	Rio Yaguaron	Paso Centuri	1980-1994	D/M	N
	06.01.1997	3458100	Rio Santa Lucia	Paso Pache	1983-1994	D/M	N
	06.01.1997	3471300	Rio Cebollati	Picada de Corbo	1980-1994	D/M	N
	06.01.1997	3471400	Rio Olimar	Treinta y Tres	1980-1994	D/M	N
	06.01.1997	3469210	Tacuarembo	Paso Borracho	1980-1994	D/M	N
	06.01.1997	3469300	Caraguata	Paso de las Toscas	1980-1994	D/M	U
USA	30.09.1997	4102100	Kuskokwim	Crooked Creek	1951-1993	D	U
	30.09.1997	4115200	Columbia	The Dallas	1878-1993	D	U

Country	Date	GRDC-No.	River	Station	from-to	**D**aily **M**onthly	**N**ew **U**pdate
	30.09.1997	4146280	Sacramento	Sacramento	1948-1979	D	U
	30.09.1997	4143550	St. Lawrence	Cornwall	1935-1994	D	U
	30.09.1997	4147700	Susquehanna	Harrisburg	1993-1996	D	U
	30.09.1997	4150500	Brazos	Richmond	1903-1993	D	U
	30.09.1997	4149400	Alabama	Claiborne	1930-1975	D	U


AVAILABLE DATA IN THE GRDC DATABASE
- Stations from all Regions -
Number of Stations
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1800
1810
1820
1830
1840
1850
1860
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
5-Year-Interval
total number of stations: 3,658
stations with daily data: 2,184
stations with monthly data: 3,232
Daily
Monthly
Status: December 1997

Annex 3

GRDC-Stations
Status: December 1997



POLICY GUIDELINES FOR THE DISSEMINATION OF DATA AND COSTING OF SERVICES

Annex 4

Preamble

The Global Runoff Data Centre (GRDC) operates under the auspices of the World Meteorological Organization (WMO), on the advice of its international Steering Committee and in cooperation with organizations such as UNESCO, UNEP, WHO and ICSU. These Guidelines regulate the acquisition and dissemination of hydrological data and the costing of services by the Global Runoff Data Centre under the Terms of Reference stipulated during the First Session of the Steering Committee of the GRDC and the committments of WMO made at its Twelfth Congress in 1995.

At its Twelfth Congress, the World Meteorological Organisation (WMO) adopted Resolution 40 (Cg-XII) and thus committed itself, as a fundamental principal, "to broadening and enhancing the free and unrestricted international exchange of meteorological and related data and products." In this context, "free and unrestricted" means non-discriminatory and without charge, the latter with the meaning "at no more than the cost of reproduction and delivery, without charge for the data and products themselves." With regard to the Global Runoff Data Centre, Congress also adopted Resolution 21 (Cg-XII) which encourages Members (countries) "to support the GRDC through the provision of the hydrological data and related information that it needs".

WMO Congress also adopted the practice that countries "should provide to the research and education communities, for their non-commercial activities, free and unrestricted access to all data and products exchanged under the auspices of WMO" with the understanding that the commercial use of these data may be subject to conditions." Resolution XII-4 (Paris, September 1996) of the UNESCO Intergovernmental Council for the International Hydrological Programme (IHP) "Invites Member States to review their policies for the international exchange of hydrological data so that they may be supportive of the research being undertaken on major global issues" and further "Requests the IHP National Committees to work with their national Hydrological Services to provide the scientific community with access to hydrological data and information needed for research at regional and international levels... using the internationally recognized international data centres".

These Guidelines do not infringe on the ownership rights of the data transmitted to the GRDC by Members (countries and their national agencies) and other data providers. In particular, the GRDC does not usually provide to data users value-added and costed services which would normally fall in the domain of Members and other data providers, in particular national Hydrological Services.

1. Principles of data acquisition and access

1.1 The GRDC operates on the WMO principal mentioned above with the aim of encouraging the widespread use of the data for national, regional and global studies.

1.2 Members and other data providers are encouraged to transfer to the GRDC unrestricted, quality controlled, selected hydrological data, together with station history information. The transfer of daily discharge data is preferred.

2. Dissemination of GRDC-Data

2.1 GRDC data are available to users free and unrestricted under the conditions specified in 2.2 to 2.6

below.

2.2 Requests for data must reach the GRDC in written form: letter, facsimile, telex or email. A proforma is attached for use in this respect (Annex 1).

2.3 The data user agrees in writing that the data received are not transferred to third parties without the written consent of the GRDC. GRDC data are released upon receipt of a signed User Declaration (Annex 2).

2.4 GRDC data shall not be used for commercial purposes without the prior consent of Members and other providers of data to the GRDC. The GRDC will request such consent on behalf of a potential user.

2.5 The data user agrees that the GRDC may inform the Members and other data providers of data about the use to which their data have been put and will transfer the names and addresses of the data users to Members and other data providers concerned.

2.6 The GRDC makes available subsets of the GRDC database on request, as stated above. Requests for the entire database or substantial parts of it cannot be entertained.

3. Cost of services

3.1 Information about the GRDC, including the yearly status reports and the database catalogue, are provided free of charge upon request.

3.2 To enhance the services of the GRDC, the GRDC charges data users on a non-profit base for the time used for carrying out services and for costs of material, handling and mailing.

3.3 Standard GRDC services (Annex 3) are free for agencies and institutions which contribute data to the GRDC, as well as for the secretariats of international organizations which are the principal clients of the GRDC, such as WMO, UNESCO, UNEP and WHO.

3.4 For all other users, the cost for databank queries, diskettes, mail and all other overheads is based on the current price for services charged by the Federal Institute of Hydrology, Koblenz (Annex 4).

3.5 Under special arrangements, the cost for database queries may be waived for data users of developing countries.

4. Disclaimer

While the GRDC makes every effort to eliminate errors from the data base, there may be errors in the data unknown to the GRDC. Neither the GRDC nor its sponsors can be held responsible for the consequences of the use of GRDC data.

Format for Data Request from GRDC

Any request for data should provide the following information:

a) Origin of the request, including name, postal and/or e-mail address, phone and fax number of the individual person or institute making the request; where an institute, the name and the position of the responsible officer should also be provided.

b) Specification of request (e.g. which rivers, stations or regions, monthly or mean daily data, time series).

c) Rationale for the data request.

d) Detailed description of the use to be made of the data. A summary of the research or study project should be added to the request.

e) Signature of the person or responsible officer referred to in a) above.

Declaration of the Data User

The undersigned declares that he/she is cognizant of the GRDC Policy Guidelines for the Dissemination of Data and Costing of Services and is responsible for the use of the data provided by the GRDC. The undersigned agrees to use the data under the following conditions:

1. The GRDC data are not transferred either in part or total to third parties or to the general public (e.g. by electronic media), without the written consent of the GRDC.

2. The data will not be used for commercial purposes without the written consent of the GRDC. The GRDC itself will obtain clearance from the respective Members or other data providers prior to the release of data for commerical purposes.

3. The data set will be not accessible to unauthorized persons and, after completion of the specified studies, the data set will be kept separate from the general data processing facilities on diskette, tape or CD.

4. After completion of the studies and parts thereof, two copies of the results will be made available for the GRDC, as well as publications arising from the use of the data set or parts thereof.

5. In all publications, the source of the data will be fully cited as: "The Global Runoff Data Centre, D - 56068 Koblenz, Germany".

6. The GRDC operates on a non-profit basis. In certain cases, however, the GRDC may charge the data user a nominal amount for data queries and handling or an amount which has been agreed upon between the requesting agency and the GRDC prior to data delivery. The undersigned confirms his/her capacity to pay bills presented by the GRDC for services.

7. Disclaimer

   While the GRDC makes every effort to eliminate errors from the data base, there may be errors in the data unknown to the GRDC. Neither the GRDC nor its sponsors can be held responsible for the consequences of the use of GRDC data.

I, as principal researcher/representative of the requesting organization, agree to the conditions stated above.

Place and date :_____

Signature :_____

(Annex 3 of Policy Guidelines)

Standard Services of GRDC

The following standard services are rendered on a routine basis and are distinguished from specialized services to data users:

- Production and dissemination of catalogues and yearly status reports
- Database queries and response to data requests including advisory services with regard to the use of the database
- Compilation of project/programme related sub - databases
- Production of tables and graphs to illustrate and enhance the understanding of the content of the database
- Production of reports in the GRDC - Report series for example on global/regional hydrological issues, in the interest of projects/programmes of, inter alia, WMO, UNEP and UNESCO

The GRDC holds the right to change the extend and scope of standard services without notice.

Examples of specialized services would be: detailed statistical analyses of regional time-series for specific studies; assessment reports; production of graphical displays; monitoring of global/regional runoff on a comparative basis; production of reports on special request; etc.

(Annex 4 of Policy Guidelines)

Cost of GRDC Services

1. Staff time is based on a per hour rate which in June 1997 was set at DM 75,--. This includes all overheads and mail services.

2. To give an indication of the approximate costs of databank services, the following can serve as a guide:

a) Simple queries, such as a search for all stations of three major rivers and the extraction of mean daily discharge data:

Estimated time for completion: 1.5 hours
Approximate cost (June 1997) : DM 112,50

b) Complex queries, such as the selection of daily discharge time series of at least 20 years for 20 stations from three major rivers, with maximum overlap of time series:

Estimated time for completion: 5 hours
Approximate cost (June 1997) : DM 375,--

3. For complex tasks where data products (statistical evaluations, graphics, etc.) are also requested, a cost estimate is made and agreed upon in advance.

4. Services for projects which require extensive work at the GRDC or the establishment of an own database are agreed upon in a Memorandum of Understanding (MoU) between the project partners. In these cases, the financial contribution for the services of the GRDC are costed and incorporated in the MoU.

5. Payment for services is by bank transfer to the credit of the GRDC:

BUNDESKASSE KOBLENZ, LANDESZENTRALBANK KOBLENZ
BLZ: 570 000 00, ACCOUNT: 570 010 01, credit: 1203/11902 GRDC

Cheques sent by registered mail and made payable to "GRDC" are also acceptable.

Database Requests 1997

Annex 5

Request made by (Name, country)	Country or river for which data were requested	Purpose of data use
Tommaso Abrate, Hydrology Division, World Meteorological Organisation	Database catalogue of Albania	General information about the availability of discharge data of Albania
Alfredo Constain Aragon, Hydroproiet Ltd., Cali, Columbia	Statistical data of Latin American rivers (flow, velocity)	Calibration of digital instruments (no data transferred)
Simon Bärtschi, Geographisches Institut der Universität Bern, Schweiz	22 stations in the Aral-Sea basin	Study about the media coverage of hydrological and environmental changes in the Aral-Sea region
Connely Baldwin, Civil and Environmental Engineering, Utah State University, USA	River discharge data from Columbia, Venezuela, Peru, Brazil (database catalogue)	Dynamic analysis of streamflow data (student) - request pending
Prof. Dr. D.K. Banerjee, School of Environmental Sciences, Jawaharlal Nehru University, New Dehli, India	Yamuna River, India (not present in the GRDC database)	Study on the chemical modelling of streams
Dr. Peter Becker, Battelle Marine Sciences Lab., Sequim, USA	ACSYS-reports, general information about ACSYS	PhD dissertation: The Effect of Arctic River Hydrological Cycles on the Arctic Ocean
Dr. J.M. Beckers, Université de Liege, Belgium	6 stations in the area of the Mediterranean Sea	MEDMEX (Mediterranean Models Evaluation Experiment)
Prof. Dr. Beese, Institut für Bodenkunde und Waldernährung, Universität Göttingen, Deutschland	GRDC Catalogue	Study on hydrology and water quality worlwide for the Scientific Council of the Federal Government of Germany
Byron Bodo, c/o GEMS/WATER Collaborating Centre, Ontario, Canada	GRDC catalogue	General information about GRDC database contents
J. Böhner, Geographisches Institut der Universität Göttingen	Yangcun at Yaluzangbu Jiang River	Verification of models for the regionalization of climatological parameters

Request made by (Name, country)	Country or river for which data were requested	Purpose of data use
A. Brismar, Department of Water and Environment Studies, Linköping, Sweden	GRDC-Report No. 5, database catalogue, report list	General information about the availability of data in the Euphrates-Tigris Region
Dr. Axel Bronstert, Potsdam-Institut für Klimafolgenforschung e.V., Germany	16 stations in the North-East of Brazil	Development of a hydrologic model in certain areas in the North-East of Brazil
Ted Bryant, University of Wollongong, Australia	GRDC-Reports 5 and 10	Interaction between river discharge and sea level as indicators of the world water balance
Zhou Caiping, The Chinese Academy of Sciences	Data for the Brahmaputra River (database catalogue extract)	N.N.
Anny Cazenave, Laboratoire d´Oceanographie et de Geophysique, Toulouse, France	Data of rivers discharging into large lakes (database catalogue)	Study: global climatologies and the annual lake cycles
Chen-Hua Chung, Dept. of Civil Engineering, Colorado State University	Discharge data of the Niger River	Study: Return period and risk analysis for hydrologic and environmental processes
Arthur Lyon Dahl, DAED, Coordinator, UN System-wide Earthwatch, Geneva, Switzerland	GRDC report list	Preparation of a bibliography of major reviews and metadata sources relating to international waters
Georgi Daskalov, ORSTOM-HEA, CESMA, Montpellier, France	27 rivers draining into the Black Sea	Research project: Evolution of the Black Sea production ecosystem in relation to environmental changes and anthropogenic influence
Michael Dettinger U.S. Geological Survey	River discharge data for 14 rivers from China, Canada, Iceland, Denmark, United Kingdom	Assessment of climatic change and hydrological consequences in the Sierra Nevada and other parts of the Western United States

Request made by (Name, country)	Country or river for which data were requested	Purpose of data use
Dr. Isabelle Niang-Diop, Département de Géologie, Université Cheik Anta Diop, Dakar-Fann, Senegal	----------	Request for general support in the preparation of a database for the coastal zone of Senegal
Jay Famiglietti, Dept. of Geological Sciences, University of Texas, Austin, USA	GRDC report No. 10	Possible incorporation of GRDC data in an oceanic global climate model
Jane Foster, Dept. of Geology and Geophysics, Yale University, New Haven, USA	9 rivers of Southwest Asia	Investigation exploring climate variation and the effect on agricultural production in Southwest Asia
Christian France-Lanord, Dept. of Geological Sciences, Cornell University, Ithaca, USA	GRDC Reports No. 5 and 10	General scientific interest
Paul Ganahl, Hydrographische Abteilung der Verbund-Elektrizitäts-werke Kaprun	Discharge data of the Spanish Rivers Tortoza and Zaragoza	Examination of possible climatic changes in the Ebro basin
Philippe Gauzelin, Space Oceanography Departement, CLS, Toulouse, France	Mediterranean Region (general information about data availability, request pending)	PhD thesis about the water and heat flux budget of the Mediterranean Sea
Pieter van Gelder, Delft University of Technology, The Netherlands	Discharge data of stations in the Oder catchment (database catalogue)	Frequency analysis of extreme values (maxima)
Christian Gerbich, Inst. für Biogeochemie und Meereschemie, Hamburg, Germany	Several rivers in the tropical and subtropical region of Asia	Modelling transport mechanisms of solid and dissolved matters in oceans and rivers
Marc Gordon, Centre for Arid Zone Studies, UK University of Cambridge	Historical streamflow data for the Benue River Basin (catalogue)	MSc Dissertation in Water Resources

Request made by (Name, country)	Country or river for which data were requested	Purpose of data use
Steve Graham, Dept. of Geological Sciences, University of Texas, Austin, USA	Report No. 10, 5, 12, 14	General scientific purposes
Dr. Alan Hall, Australia	GRDC catalouge for Australia	General reference purposes
G. Hartmann, Institut für Wasserbau, Universität Stuttgart	GRDC database catalogue	General information about the availability of discharge data in Africa and the Middle East
Martin Hollingham, University of Wales, Bangor, UK	GRDC report No. 5 and No. 10, Status Report 1996	General research work and educational purposes
Kaisa Hietala, Scott Polar Research Institute, University of Cambridge, U.S.A	35 ACSYS-stations	PhD thesis: Fresh water variation on the Arctic Ocean
Noboyuki Imanishi, Shinko Research Ltd., Tokyo, Japan (research company of Kobel Steel Ltd.)	GRDC database catalogue	Global Potential of hydrogen gas production by hydropower (no transfer of raw data - commercial use)
S.R. Jones, Engineering Consultant, The Harroway, Whitchurch, UK	Data of the Casamance River, Senegal (data not available at GRDC)	Undersea fiber optics cable project South America - Africa
Shinya Kakuta, Ocean Research Department, Japan marine science and technology center, Yokosuka, Japan	Data of the Yukon River	Model study within ACSYS (Arctic Climate System Study)
Frank Kaspar, Wissenschaftl. Zentrum für Ökosystemforschung, Universität Kassel, Germany	43 stations from South America	Global modelling of consumption, availability of water and prognosis
Prof. Kempe, Geologisch-Paläontologisches Institut, Technische Universität Darmstadt, Germany	Database catalogue of Argentina (request pending)	EU-research project: biogeochemistry of of Argentinian Rivers

Request made by (Name, country)	Country or river for which data were requested	Purpose of data use
Chris Kilsby, Water Resources Systems Res. Lab., Univ. of Newcastle upon Tyne, UK	GRDC database catalogue (request pending)	General information
Tokuo Kishi, Surface Hydrology Modeling Team, NIED, Science & Technology Agency, Japan	General information about availability of data of the GRDC (request pending)	Study on the hydrologic characteristics of major rivers of the world
Wulf Klohn, Food and Agricultural Organisation of the United Nations, Rome, Italy	31 rivers of the Amu Darya and Syr Darya region	Study of water resources of river basins in the countries of the former SU within the FAO´s Aquastat Programme
Jumpei Kubota, Faculty of Agriculture, Tokyo University of Agriculture and Technology, Japan	Discharge data for 14 Arctic rivers	GAME-Siberia (GEWEX related Asian Monsoon Experiment) Project
Dr. D. Krämer, World Meteorological Organisation, Genf, Switzerland	Discharge data for 8 stations in mountainous regions	Edition of the book "State of the World Mountains 1997"
Dr. Gerhard Lammel, Max-Planck-Institut für Meteorologie, Hamburg	Zaire, Senegal, Nile	Contribution to a report of the Scientific Council for Environmental Changes of the Federal Government
Richard Lammers, University of New Hampshire, Durham, USA	Arctic Region	Reports 8, 12, 15 (ACSYS-Reports)
Howard Lawes, Noble Denton Europe Ltd., London	General data (means) for the Irrawaddy River Report No. 5	Design of a submarin pipeline through the Irrawaddy delta
Prof. Lemke, Institut für Meereskunde, Universität Kiel	Several major rivers of the world	Educational; general statistical evaluation
Winchee Lin, School of Oceanography, University of Washington, USA	Discharge data for 34 rivers in the South East Asia Region	Validation of a model for the biogeochemistry of rivers

Request made by (Name, country)	Country or river for which data were requested	Purpose of data use
Dr. Dag Lohmann, Department of Civil Engineering and Operations Research, Princeton University, USA	161 stations globally distributed	Modeling of global soil moisture, evaporation and runoff with the VIC-2L model
Sarith Mahanama Dept. of Civil & Structural Engineering The University of Hong Kong	16 stations in the Mekong River Basin	Validation of GCM with respect to daily river runoff
Lee McKinney, Sverdrup Technology, Stennis Space Center, USA	10 stations of rivers discharging into the East Asia Sea	Ocean modelling project in the East Asia Sea
John Maingi, Office of Arid Lands, University of Arizona	Tana River (Kenya), Station Garissa (request for data of 1993-1997 - not available)	Dissertation: Land use and vegetation change in response to river basin development in the lower Tana River Basin in Eastern Kenya
Dr. Jonathan I. Matondo, GEP Department, University of Swaziland, Swaziland	Several African Rivers (request pending)	Study about the variability of runoff of large African Rivers
James McManus, NASA/Goddard Space Flight Centre, Greenbelt, U.S.A.	General information (database catalogue)	Database catalogue for general information
Norman L. Miller, Climate & Integrated Systems Atmospheric Science Division, Lawrence Livermore National Laboratory, University of California, U.S.A.	For 30 rivers, globally distributed: monthly time series and extreme values of discharge	Research project: Large-scale comparison of water vapor convergence, precipitation and evaporation in the NCEP reanalysis with monthly streamflow
Mohamed Ali Ahmed, IHE Delft, The Netherlands	6 stations from the River Nile, GRDC-report No. 5	Study: flow prediction with an artificial neural network

Request made by (Name, country)	Country or river for which data were requested	Purpose of data use
Ellyn T. Montgomery, Physical Oceanographie Dept., Woods Hole Oceanographic Institution, Woods Hole, USA	Report No. 10 and database catalogue, standard data set of 160 stations	Possible use of GRDC data in the research field of oceanic heat and water fluxes, calculation of fluxes into the Atlantic Ocean
Mool, ICIMOD, Kathmandu	Indus, Yangtse, Yellow River	Project of FAO and SIDA: Forestry and key Asian watersheds
Ragu Murtugudde, NASA/GSFC, Greenbelt, USA	Discharge time series for major rivers (catalogue, request pending)	Ocean model simulations
Nicholas O´Connor, UNEP/DEIA/GRID-Geneva, Chatelaine, Switzerland	General information about environmental-related databases	Research project: Information systems with respect to resolving environmental conflicts
Taikan Oki, NASA / Goddard Space Flight Centre, Greenbelt, U.S.A.	130 river discharge stations worldwide	Research project: Estimating of global runoff distribution (global gridded runoff)
Taikan Oki, NASA / Goddard Space Flight Centre, Greenbelt, U.S.A.	80 river discharge stations worldwide	Research project: Estimating of global runoff distribution (global gridded runoff)
Y. Peyvastehgar, Essen	Discharge data from rivers draining into the Caspian Sea (database catalogue)	Dissertation: Sea level changes and regional planning in the Caspian Sea
Tan Yong Piu, Rapporteur for WCP-Water, Government of Signapore, Met. Service	Database catlogue files for the countries of Oceania and Australia	Information about the GRDC databases contents concerning Regional Association V of the WMO
Edward V. Podgaisky and Laghoali Driss, Russia State Hydrometeorological Institute, St. Petersburg, Russia	Discharge data of 12 rivers from Morocco	Dissertation / diploma (subject not known)
Matthias Prange, Alfred-Wegener-Institut, Bremerhaven, Deutschland	GRDC Reports 8, 10, 12	General scientific interest

Request made by (Name, country)	Country or river for which data were requested	Purpose of data use
Dr. Roger Proctor, Proudman Oceanographic Lab., Bidston Observatory, Birkenhead, Merseyside, UK	Data from rivers discharging into the European Shelf Seas, including the Baltic Sea (database catalogue)	Project LOIS (Land Ocean Interaction Study)
Dr. T.V. Ramachandra, Indian Institute of Science, Bangalore, India	Database catalogue, GRDC reports No. 1, 5, 9, 10, 12, 13, 14 and general information material	General information about the availability of GRDC data, data products and software
Prof. V.J. Rayward-Smith, School of Information Systems, University of East Anglia, UK	Ob, Yenesei, Lena	Study about interaction between winter precipitation in Central Asia, river flow, Arctic ice cover and European climate
Liang Ren, Dept. of Hydrology, Hohai University, Nanjing, China	General information about the available GRDC data sets	N.N.
Lars Ribbe, Fachhochschule Köln, Institut für Tropentechnologie, Köln, Germany	River Barada, Syria	Water Resources Managment in Arid Regions - A Case Study of Damascus Region (Diploma)
Matthew Rodell, Dept. of Geological Sciences, University of Texas, Austin, USA	71 stations of major rivers of the world	Computation and analysis of water balances over large river basins of the world
Mark W. Rosegrant and Claudia Ringler, International Food Policy Institute, Washington, U.S.A.	Discharge data for Maipo River (Chile)	Research project: Modelling of water resource allocation, estimation of agricultural production and others
Dr. K. Rubinstein, Hydrometeorological Centre of Russian Federation, Moscow	Dataset of 160 stations (flux calculation stations)	Study: Role of large-scale water cycle in global climate system
Dr. B. Rudolf, Global Precipitation Climatology Centre (GPCC), Offenbach, Germany	55 stations worldwide	General research purposes, collaboration GRDC/GPCC, precipitation/runoff comparison study

Request made by (Name, country)	Country or river for which data were requested	Purpose of data use
Cord Ruhe, International Baltex Secretariat, GKSS Forschungszentrum Geesthacht, Deutschland	7 river discharge stations from Russia and Finnland	Examination of river runoff processes in the Baltex-area
K. Schulte, University of Colorado, Boulder	Database catalogue of Albania	General information about the availability of discharge data of Albania
Bernd Schwan, IUS GmbH, Heidelberg, Germany	3 rivers from Poland	Environmental Impact Assessment for the German Waterways and Shipping Administration
Bernd Schwan, IUS GmbH, Heidelberg, Germany	9 stations from the Oder	Environmental Impact Assessment for the German Waterways and Shipping Administration
Prof. Igor Shiklomanov, Russia State Hydrological Institute, St. Petersburg, Russia	3 stations from Rhein, Weser, Elbe	Analysis of changes of river runoff of the Northern Hemisphere in different time periods
Dr. Laurence C. Smith, University of California, Los Angeles, Dept. of Geography, USA	GRDC Report No. 12	General information
Alejandro Spitzy, Institut für Biogeochemie und Meereschemie, Universität Hamburg, Germany	Database catalogue extract for Malaysia	General information about availability of gauging stations in Malaysia
Ronald E. Stewart, Climate Processes and Earth Observation Division, Atmospheric Environment Service, Canada	General information about GRDC	Presentation of GRDC in meeting of GEWEX Hydrological Panel (GHP)
Dr. Kevin Telmer, Geological Survey of Canada	General information about the availability of GRDC data	Research projects about the biogeochemistry of rivers

Request made by (Name, country)	Country or river for which data were requested	Purpose of data use
Dr. Dusan Trninic, Meteorological and Hydrological Service, Zagreb, Croatia	20 stations from the Danube River basin and its tributaries	IHP-UNESCO research project: Relationship between precipitation, air temperature and discharges over the Danube river basin
Wolfgang Vosseler, Chemnitz, Germany	Hydrological data from China (database catalogue)	Study: Situation of the drinking water provision and waste water managment in China
Dr. Rolf Weingartner, Geographisches Institut der Universität Bern, Gruppe für Hydrologie, Schweiz	52 rivers worldwide	Contribution for Freshwater Conference of the UN Commission for Sustainable Development: "Mountains of the world - Water towers for the 21st Century"
Wiley, A. U.S. Army Topographic Engineering Centre Alexandra, VA, U.S.A	All rivers of Ecuador (this request was approved by the Government of Ecuador)	Water resources appraisal
Yonkang Xue, Center for Ocean-Land-Atmosphere Studies, Calverton, U.S.A.	Database Catalogue of East Asia	Database catalogue for a planned research project
W. F. Zimmermann, Consortium for International Earth Science Information Network	GRDC catalogue	General information about international shared water resources
Dr. Franz Zunic, Lehrstuhl für Wasserbau und Wasserwirtschaft, Technische Universität München, Germany	6 stations worldwide with long time series	Synthetic generation of discharge time series

Transformation of Measured Runoff Data to Grid Points

Karlheinz Daamen

Within the framework of a national research project funded by the Federal Ministry of Education and Research (BMBF), methods for the calculation of grid-based runoff on a 0.5° x 0.5° grid were extended and verified for the Weser and Elbe catchments. Simultaneously, the project contributed also to the WMO WCP- Project B.3: Development of Grid-related Estimates of Hydrological Variables. Only the area-weighted runoff balancing (method 1) enables to calculate the grid-based runoff exclusively from gauge-based runoff data, although it is only applicable to areas with a high gauging station density. Data acquisition and assimilation, as well as the digitization of gauge-bases catchment limits are highly time-consuming. This method, therefore, may only be used for selected regions for which it may serve as a reference data set for the evaluation of the quality of the other methods, too.

The disaggregation of runoff by the use of statistical relationships between runoff and catchment characteristics (method 2) needs, at least at topographically more intensively structured relief, the inclusion of long-term mean areal distribution of precipitation depth. By this procedure, empirical relationships between runoff and precipitation as well as further catchment characteristics can be established. The relationships are regionally differentiated. The influence of evapotranspiration on runoff is not explicitly taken into consideration within the computational scheme. Therefore, this method was not further investigated within the project.

With respect to a possible continent-wide applicability, the water balance model of Thornthwaite-Mather was extended. The model WABIMON enables the calculation of long-term mean grid based runoff using the existing global hydrometeorological and physiographic data sets. Combined with the monthly means of runoff at selected reference gauges, the time-dependent grid-based runoff can be calculated.

Improvements in future projects have to be done in the model components of the water balance model, especially the parameterization of runoff coefficient, and in the selection criteria of the reference gauges. For this task, the runoff data of the Global Runoff Data Centre (GRDC) and the precipitation data (Rudolf et al., 1992) of the Global Precipitation and Climatology Centre (GPCC) of Europe are foreseen for evaluation. Method 3 forms the basis for the calculation of timely monthly overviews of grid-based runoff planned by the GRDC.

The project has finished at the end of 1995. The results have been documented in a report (BfG, 1997).

References

BfG (1997): Übertragung von gemessenen Abflußwerten auf Gitterpunkte, BFG-1062, Koblenz.

Rudolf, B., Hauschild, H., Reiss, M. & Schneider, U. (1992): Die Berechnung der Gebietsniederschläge im 2,5°-Raster durch ein objektives Analyseverfahren. *Meteorologische Zeitschrift* **1**, S. 32-50.

The Development of a GIS-supported Water Balance Model as a Tool for the Validation of Climate Models and Hydrometeorological Datasets

P.Krahe

A monthly water balance model is currently in development at the BfG which shall be used for continental hydrologic modelling with respect to climate models (GCM's) and the development of global water ressources.

The following applications of the Water Balance Model are carried out or planned in the future:

* Estimation of monthly gridded runoff on continental scale in combination with discharge data stored in the GRDC
* Test of consistency and homogeneity of discharge data stored in the GRDC
* Verification of model parameter of hydrological models used in global and regional climate models and development of parameter estimation techniques using measured discharge data and GIS-datasets
* Reliability of gridded global precipitation and meteorological data sets derived from measured data
* Verification of water balance components of global and regional climate models
* Study of availibility of water resources and their possible change in regard of global greenhouse warming

The water balance model applied is a variation of a scheme which was first proposed by Thornthwaite and Mather (1957) and subsequently has been transposed in todays notation with slight modification by Vörosmarty et al.(1989). Improvements with regard to the production of direct and delayed runoff are introduced in the previous schemes. To run the model gridded rainfall and temperature data are needed. Soil and landuse data stored in a Geographical Information System are used for the calculation of model parameters.

The model was applied for Central Europe using a rainfall dataset of GPCC within the project "Transformation of Measured Runoff Data to Grid Points" (BfG, 1997) and verified for the german catchment areas of the rivers Danube, Rhine, Weser, and Elbe. The results indicate that the model can be used for the estimation of monthly gridded runoff if measured discharge data are used for correction of errors related to the model and the rainfall- resp. temperature data.

The model is very sensitive against the quality of the rainfall data. Therefore it can be used to test the reliability of gridded global meteorological especially rainfall datasets derived from measured data as well the output of climate models. An example is given by Krahe and Grabs (1996) for Central Europe using a rainfall dataset of GPCC.

Beside the simple structure of the model, it can also be used to test the reliability of presently available global datasets of soil and landuse parameters to simulate the hydrological cycle in climate models. The studies have shown that an improvment of estimation techniques for parameters of runoff production in continental hydrological models is necessary. The activitities of the BfG are concentrated on the development of parameter estimation techniques for recession coefficients of baseflow based on geological and hydrogeological maps (Krahe et al.,1997).

The applications of the model have already shown that some further developments of the water balance model are needed. The parameterization of the runoff coefficient to model the effect of

infiltration excess runoff will be improved using an extended precipitation climatology and a probability-distributed soil moisture storage.

In further studies a validation and verification of the Water Balance Model is planned for the whole territory of Europe using the discharge data stored in the GRDC and precipitation datasets of GPCC.

Literature

BfG (1997): Übertragung von gemessenen Abflußwerten auf Gitterpunkte, BfG-1062, Koblenz

Krahe P. and W. Grabs (1996): The Development of a GIS-supported Water Balance Model as a Tool for the validation of Climated Models and Hydrometeorological Datasets. WMO/IAHS Workshop on Continental Scale Hydrological Models: Charting the Future,11-13 November 1996, Wallingford

Krahe P., K-H. Daamen, R. Mülders and K. Wilke (1997): GIS-related baseflow simulation for water balance and precipitation-runoff modeling in the River Rhine basin. IAHS Publication no. 242

Thornthwaite, C.W. and J.R. Mather (1957): Instructions and tables for computing potential evapotranspiration and the water balance. Drexel Institute of Technology, Laboratory of Climatology , Publications in Climatology, 10, (3), Centeron, New Jersey

Vörösmarty C.J., B. Moore III, A.L. Grace, et al. (1989): Continental Scale Models of Water Balance and Fluvial Transport: An Application to South America. Global Biogeochemical Cycles, Vol. 3, No. 3, 241-265

Statistical evaluation of European and selected world-wide GRDC stations discharging into the oceans

Felix Portmann

The principal objectives for the statistical analysis of streamflow into the oceans are: The validation of computed runoff into the oceans derived from global circulation models (GCM), the variability of these flows, possible changes in Arctic Ocean water budget and the thermohaline circulation in the Oceans, especially the Atlantic Ocean in order to simulate accurately possible climate changes and their impacts on changes of climate zones and the transport of matter into the oceans. Within this context, an indication of possible jumps and trends can help to identify the impact of medium-term climate variations, e.g. relatively much or less rainfall induced by increased or decreased anticyclonic activity during a certain historical period of time.

With this scope in mind, a selection of GRDC monthly time series of 22 European and 11 Non-European stations, within the period 1805 until 1996, was statistically evaluated by the use of publicly available programmes. The programmes were developed for the WCP-Water Project A.2 of WMO, as HOMS (Hydrological Operational Multipurpose System)-component by Czech Hydrometeorological Institute CHMI and for a project financed by the European Union by the Ruhr-Universität Bochum (RUB).

The statistical methods and the results, as well as a short interpretation of the results will be published in a forthcoming GRDC report.

Although the total period covered is from 1807 up to 1996, most series are shorter and start in the first half of this century. To cope with sometimes present missing values, in the case of very short time series gaps were closed either by the mean of the respective month or by statistically significant linear regression with data from adjacent months.

Most of the series are distributed according to normal distribution, in 3 cases in Europe according to log-normal distribution, in 1 case of a Siberian station no successful transformation was possible, due to sometimes extremely low discharge in comparison with mean discharge.

The basic statistics were calculated by the programmes of WMO and CMHI.

The range of the discharge is from 7 m^3/s up to 30600 m^3/s mean discharge and a mean discharge per unit area of 0.2 $l/(s*km^2)$ up to 36.6 $l/(s*km^2)$. Annual minimum is 5 m^3/s, annual maximum 37100 m^3/s, while the absolute monthly minimum and maximum are 0 m^3/s and 112000 m^3/s, respectively.

Jumps and trends were analysed mainly with the programmes of CHMI and RUB.

Jumps are observed only rarely in annual series, at 6 European stations and perhaps only 1 non-European station.. If observed, they mostly occur in the 1960ies and 1970ies, while for most of the series no association with the installation of large dams in the river basin was possible. For Northern Europe, such jumps occur first between the years 1962/63, 1967/68 and 1978/79. In Southern

Europe, 1962/63, 1966/67 and 1972/73/74 are the respective years. A relationship with dam completion are possible for the Spanish River Jucar for jumps in 1954/55 (dam completion in 1956), but not in 1935/36 (no dam). Jumps in the series of individual months may be present when the annual series does not show any significant jump.

Trends are observed for the annual series for most of the series. However, as a rule, the longer the series, the smaller are the trends. The respective correlation coefficients are small in most cases. For the longest series, the yearly decrease or increase in percentage of the series' mean is only 0.15 % as a maximum value, while the correlation coefficients are small, with explained variance (R^2) of only 1 to 5 %.

Region	River	Time series	Mean discharge [m³/s]	Slope of trend [m³/s*year]	Slope/mean [%]	R
Central Europe	Loire	1863-1979	838	+1.22	0.15	0.15
Northern Europe	Vaenern-Goeta	1807-1992	534	-0.19	0.04	0.10
Northern Europe	Northern Dvina	1882-1985	3315	-4.65	0.14	-0.22

Nevertheless, for sub-series significant trends are observed at the end of the series, mostly starting in the 1970ies. For rivers in Europe and Siberia, the trends cannot be associated to dams construction in most cases. The strongest trends normally start in 1969-1970 or 1976-1977, only in exceptional cases in 1953 and 1986. The effect of dams might be induced for trends of River Orinoco for a starting in 1981 (dam in 1982), and of River Paraná in 1968 (dam in 1968). As for jumps, significant trends in the series of individual months may be present when the annual series does not show any significant trends.

Commented Status of Membership in the GRDC Steering Committee
Status: 11/1997

Annex 9

Member	Status	Affiliation with GRDC	Remarks
WMO	Institutional Member	OHP, WHYCOS, WCP-Water, WCRP	GRDC is technically guided through Hydrology and Water Resources Division (HWRD) of WMO
UNESCO	Institutional Member	IHP	Cooperation with IHP-related programmes, especially FRIEND
UNEP/WHO	Institutional Member	GEMS/Water	Cooperation with GEMS collaborating data centre on water quality; cooperation in water-related programmes of UNEP and WHO
World Bank	Institutional Member	Development of global water strategies, projects	WB has not yet attended a GRDC Steering Committee meeting. GRDC has visited World Bank on several occasions, contacts are continuing on individual levels
ICSU	Institutional Member	GEWEX, Science programmes	The Director, WCRP had been nominated by ICSU to represent ICSU in the 3rd GRDC-Steering Committee meeting
GPCC	Institutional Member	Global Data Centre	Collaboration with GRDC in science projects, especially gridded data products
Government of Japan	Government	Special Arrangement	Japan is a key player in water-related bi-lateral assistance in Asia. There is an underrepresentation of Asia in science, technology and water-related programmes in GRDC-related activities
H.-J. Liebscher	Individual Member	Chairman, GRDC	Nominated by WMO
K. Wilke	Individual Member	Head of Section, FIH	Nominated by Federal Institute of Hydrology, Koblenz
Z. Kaczmarek	Individual Member	Head of Hydromet. Service, Poland	Nominated by WMO
WMO/CHy	Ex-Officio	Working Groups Hydrology	Direct links in terms of policy issues and general operation of GRDC in the interest of CHy, link function to Congress
GHP	Ex-Officio	GEWEX Hydrometeorological Panel	Direct link to WCRP, GEWEX and Continental Scale Experiments in the context of GEWEX
FRIEND	Ex-Officio	Cooperation with IHP	Direct operational links with regional FRIEND projects; representation of FRIEND by Institute of Hydrology, Wallingford (European Water Archive)
President, FIH	Observer	Chief Administrator, host for GRDC	Key person in terms of GRDC financial and manpower resources support provided by the government of Germany
Ad-hoc	Observer	On special invitation	Invitations for discussions e.g. of programmes, science projects, advisory services
W. Grabs	Secretary, GRDC	Head of GRDC	Implementation of recommendations of the Steering Committee

Reference of GRDC Reports

Report No. 1 (May 1993)	Second Workshop on the Global Runoff Data Centre, Koblenz, Germany, 15 - 17 June, 1992.
Report No. 2 (May 1993)	Dokumentation bestehender Algorithmen zur Übertragung von Abflußwerten auf Gitternetze. (Incl. abtract in English by the GRDC: Documentation of existing algorithms for transformation of runoff data to grid cells) by G.C. Wollenweber.
Report No. 3 (June 1993)	GRDC - Status Report 1992.
Report No. 4 (June 1994)	GRDC - Status Report 1993.
Report No. 5 (November 1994)	Hydrological Regimes of the Largest Rivers in the World - A Compilation of the GRDC Database.
Report No. 6 (December 1994)	Report of the First Meeting of the GRDC Steering Committee, Koblenz, Germany, June 20 - 21, 1994.
Report No. 7 (June 1995)	GRDC - Status Report 1994.
Report No. 8 (July 1995)	First Interim Report on the Arctic River Database for the Arctic Climate System Study (ACSYS).
Report No. 9 (August 1995)	Report of the Second Meeting of the GRDC Steering Committee, Koblenz, Germany, June 27 - 28.
Report No. 10 (March 1996)	Freshwater Fluxes from Continents into the World Oceans based on Data of the Global Runoff Data Base.
Report No. 11 (April 1996)	GRDC - Status Report 1995.
Report No. 12 (June 1996)	Second Interim Report on the Arctic River Database for the Arctic Climate System Study (ACSYS).
Report No. 13 (Februray 1997)	GRDC Status Report 1996

Reference of GRDC Reports

Report No. 14 (February 1997)	The use of GRDC - information Review of data use 1993/1994. Status: January 1997
Report No. 15 (June 1997)	Third Interim Report on the Arctic River Data Base (ARDB) for the Arctic Climate System Study (ACSYS): Plausibility Control and Data Corrections (Technical Report)
Report No. 16 (August 1997)	The GRDC Database. Concept and Implementation.
Report No. 17 (Sept. 1997)	Report on the Third Meeting of the GRDC Steering Committee, Koblenz, Germany June 25-27, 1997

List of Acronyms used in this Report	
ACSYS	Arctic Climate System Study
ARDB	Arctic River Database
CHMI	Czech Hydrometeorological Institute
CSE	Continental Scale Experiment (within GEWEX-GHP)
DMIP	Data Managment and Information Panel (within ACSYS)
ESCAP	Economic and Social Commission for Asia and the Pacific
EU	European Union
FIH	Federal Institute of Hydrology, Koblenz, Germany
FRIEND	Flow Regimes from International and Experimental Network Data
GCOS	Global Climate Observing System
GEMS/Water	Global Environment Monitoring System
GEWEX	Global Water and Energy Cycle Experiment
GHP	GEWEX Hydrometeorological Panel
GPCC	Global Precipitation Climatology Centre
GTOS	Global Terrestrial Observing System
HKH-FRIEND	Hindu-Kush-Himalaya FRIEND (see FRIEND)
HOMS	Hydrological Operational Multipurpose System
IGBP-LOICZ	International Geosphere-Biosphere Project: Land-Ocean Interaction in the Costal Zone
IHP	International Hydrological Programme (of UNESCO)
INTAS	International Association for the promotion of cooperation with scientists from the independant states of the former Soviet Union
Med-HYCOS	Mediterranean Hydrological Cycle Observing System (within WHYCOS)
NOAA	National Oceanic and Atmospheric Administration
OHP	Operational Hydrological Programme (of WMO)
ORSTOM	L'Institut français de recherche scientifique pour le développement en coopération
RUB	Ruhr-Universität Bochum
SADC-HYCOS	South African Development Commission Hydrological Cycle Observing System
UN	United Nations
UNEP	United Nation Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WCP-Water	World Climate Programme Water
WHO	World Health Organisation
WHYCOS	World Hydrological Cycle Observing System
WMO	World Meteorological Organisation